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POPULATION AND DEMOGRAPHY

Report No. 12

Levels and Recent Trends in Fertility and Mortality in Colombia

Hania Zlotnik

Committee on Population and Demography
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PREFACE

The Committee on Population and Demography was established in April 1977 by the National Research Council, in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, about the existence and extent of recent changes in fertility, and about the factors determining reductions in fertility.

In 1963, a Panel on Population Problems of the Committee on Science and Public Policy of the National Academy of Sciences published a report entitled The Growth of World Population. The appointment of that panel and the publication of its report were expressions of the concern then felt by scientists, as well as by other informed persons in many countries, about the implications of population trends. At that time, the most consequential trend was the pronounced and long-continued acceleration in the rate of increase of the population of the world, and especially of the population of the poorer countries. It was estimated in 1963 that the annual rate of increase of the global population had reached 2 percent, a rate that, if continued, would cause the total to double every 35 years. The disproportionate contribution of low-income areas to that acceleration was caused by rapid declines in mortality combined with high fertility that remained almost unchanged: the birth rate

was nearly fixed or declined more modestly than the death rate.

Since the earlier report, however, the peak rate of growth in the world's population has apparently been passed. A dramatic decline in the birth rate in almost all the more developed countries has lowered their aggregate annual rate of increase to well below 1 percent, and the peak rate of increase has also apparently been passed in the less-developed parts of the world as a whole. A sharp decline in fertility in many low-income areas has more than offset the generally continued reduction in the death rate, although the rate of population increase remains high in almost all less-developed countries.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the Committee on Population and Demography was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. The committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);

3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks; it initiated work on the third task in 1979.

The committee approaches the first task through careful assessment, by internal and external comparison, and through analysis, by application of the most reliable methods known, of all the data sources available. Each of the country studies therefore consists of the application of a range of methods to a number of data sets. Best estimates of levels and recent trends are then developed on the grounds of their consistency and plausibility and the robustness of the individual methods from which they were derived.

The committee's second task, refinement of methodology, is seen as a by-product of achieving the first. The application of particular methods to many different data sets from different countries and referring to different time periods will inevitably provide valuable information about the practical functioning of the methods themselves. Particular data sets might also require the development of new methodology or the refinement of existing techniques.

The committee set three criteria for identifying countries to study in detail: that the country have a population large enough to be important in a world view; that there be some uncertainty about levels and recent trends of fertility or mortality; and that sufficient demographic data be available to warrant a detailed study. After a country has been selected for detailed study, the usual procedure is to set up a panel or working group of experts, both nationals of the country and others knowledgeable about the demography and demographic statistics of the country. The role of these panels and working groups, which generally include at least one committee member, is to carry out the comparisons and analyses required. A small staff assists the committee, panels, and working groups in their work. In a few cases, including the Colombia study, a staff member has undertaken primary responsibility for analyzing available data and preparing the report.

As of early 1982, 168 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the

National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

Each country being studied has a different mix of data sources and different problems with data errors. Therefore, there is no standard pattern for all the reports. However, each report includes a summary of the main findings regarding estimates of fertility and mortality, a description of the data sources available, and a presentation of the analyses that were carried out, classified by type of data analyzed; detailed methodological descriptions are included where necessary in appendixes.

In some of the reports the estimates of fertility and mortality are presented as ranges. The use of a range is deliberate. It indicates that the panel and the committee are confident that the range includes the true value, but have concluded that the evidence does not warrant selecting a single figure as best. The range conveys an important aspect (uncertainty) of the estimation. Ideally, in constructing an average for several populations in each of which estimation is presented as a range, an aggregate range would be calculated (as the population-weighted average of the constituents). The user who selects a single figure from the middle of the range does so at the risk of misleading simplification.

This report, on levels and recent trends of fertility and mortality in Colombia, is No. 12 in a series of reports issued by the Committee on Population and Demography. In 1980 a first draft of the report was prepared by Hania Zlotnik using published materials. Jane Menken contributed a section on the analysis of child mortality differentials as inferred from the maternity history data gathered by the 1976 Colombian Fertility Survey. The committee is grateful to the World Fertility Survey and to the Corporacion Centro Regional de Poblacion for making possible the use of the fertility survey data.

A workshop to discuss the preliminary report was held in Bogota in September 1980. It was attended by some 35 experts and officials concerned with demographic measurement in Colombia. Special thanks are due to the Facultad de Estudios Interdisciplinarios of the Pontifica Universidad Javeriana for hosting the workshop in Bogota, to its director, Hector Maldonado, for helping in organizing the workshop, and to the workshop participants for their contributions and guidance in improving the

report. The many ideas and suggestions they offered during the workshop served as a basis for revision of the manuscript. In particular, the support of the Departamento Administrativo Nacional de Estadistica (DANE) in making available the National Household Survey data and the expertise of the DANE staff greatly contributed in strengthening its conclusions. Following the workshop, Dr. Zlotnik prepared a revised draft. The committee extends warm thanks to her for taking primary responsibility for the preparation of this report. Many hours of painstaking calculations and analysis were required to bring this project to completion.

The committee also wishes to thank Katherine Miller who edited the manuscript and Lois Hemphill, Benita Anderson, and Solveig Padilla for typing the manuscript. Brenda Buchbinder, administrative assistant on the committee staff while this report was being produced, helped with workshop arrangements and many other tasks, and other members of the committee staff provided advice and encouragement. Elaine McGarraugh carried out the final proofreading and other production editing tasks. The committee also notes with appreciation the Assembly reviewers of this report.

ANSLEY J. COALE, Chair
Committee on Population and Demography

SUMMARY

In 1978 the population of Colombia was the fourth largest in Latin America. At 26 million, its population was comparable to that of third-place Argentina, approximately one-third that of Mexico, and slightly greater than one-fifth that of the giant Brazil. Therefore, in regional terms, its demographic import is substantial. Furthermore, with the exception of countries like Argentina and Chile, Colombia was the first large Latin American country to experience a well-documented decline in fertility. Indications of such a decline were evident by the early 1970s, but they have become more profuse and convincing in recent years. Not suprisingly, the extent and nature of this decline have been the subject of much research. In fact, the desire to better understand its dynamics has been the most important motive propelling most of the recent surveys. For this reason, at least during the 1970s, there is no lack of data that can be used to estimate fertility.

The same cannot be said about mortality. Like many other Latin American countries, Colombia has had an operational vital registration system for a fairly long time; however, its output has never been adequate. In addition, although the country has had a fairly long history of census taking (some type of population enumeration was carried out as early as 1780), the consistency and regularity of its censuses leave much to be desired. The last three took place in 1951, 1964, and 1973, and of the three the most recent one is most deficient in terms of completeness of coverage (it understates the Colombian population by at least 8 percent). Disregarding migration and assuming as a somewhat arbitrary standard of comparison that the female population in 1964 was correctly enumerated, the final

estimates of completeness of coverage of these three censuses are 93, 98, and 89 percent, respectively.

Prior to 1964, the only sources of demographic information at the national level were the censuses and vital registration, the latter carried out mostly by the Catholic Church. Given the deficiencies inherent in these data, estimates for the 1950-64 period can be derived only by making simplifying assumptions about the characteristics of the population. In spite of this limitation, the mortality estimates for this period meet most of the consistency checks possible and are probably a good approximation to overall trends, which suggest substantial declines in mortality. During this period the detailed estimation of fertility is not possible due to the paucity of adequate data; the evidence indicates only an approximately constant level.

The National Morbidity Survey of 1965 marked the beginning of the "sample survey era" in Colombia. Although the purpose of this survey was not strictly demographic, it did explore some demographic topics and pioneered the development of the Master Sample, which has served as a basis for most of the subsequent demographic surveys. The first in this series was the 1969 National Fertility Survey, in which the main objectives were the estimation of levels, trends, and differentials in fertility. Its results were the first to indicate that fertility was decreasing, a trend that was confirmed later by the 1973 census. Soon after, the desire to monitor ongoing demographic changes closely led to more frequent use of surveys as a measurement tool. In 1976, the Colombian Fertility Survey (part of the World Fertility Survey program) was undertaken, followed in 1978 by the National Household Survey and the Contraceptive Prevalence Surveys. Although each of these surveys had a slightly different purpose, they all gathered information relevant to estimating fertility and child mortality. In addition, the 1978 National Household Survey collected data on maternal orphanhood and widowhood (death of the first spouse), which allow average adult mortality levels to be estimated for an imprecisely defined period preceding the survey. Therefore, there are fairly solid grounds on which to construct estimates of fertility and mortality of children, at least during the 1964-78 period. Among both sets of estimates, however, those corresponding to the most recent years are the least reliable, since they are based on the smallest amount of evidence.

Because substantial statistical evidence exists for the estimation of levels and trends of fertility and mortality in Colombia (especially fertility and child mortality), and since much of that evidence has previously been studied and reported, the following chapters contain an unusually long and complicated analysis. In this summary it is possible to present only the essence of major approaches and principal findings; readers who want to follow the demographic detective work and review the strengths and weaknesses of available evidence on demographic trends in Colombia are encouraged to turn to the body of the report.

This report evaluates the evidence available for estimating fertility and child and adult mortality in Colombia during the past three decades. Three main demographic indicators are treated separately: child mortality, adult mortality, and fertility.

Child Mortality

Most of the data available for estimating child mortality were gathered during the 1970s; therefore the majority of the estimates obtained refer to the 1965-76 period. Estimates for earlier periods are derived from relatively weak data (extrapolation to childhood of the mortality estimates derived via stable and quasi-stable analysis of the census age distributions), and estimates for 1977 and 1978 must be constructed without the benefit of multiple data sources that would permit consistency checks. In Chapter 2, Section 2.3.8, a final series of yearly child mortality estimates for the 1950-78 period is derived.

Table 1 and Figure 1 present the values of two parameters in this series: infant mortality (${}_1q_0$) and the probability of dying by exact age 5 (${}_5q_0$), which, for simplicity, will be referred to from here on as child mortality.

According to these estimates, infant mortality (${}_1q_0$) in Colombia declined by approximately 40 percent between 1950 and 1964, from a level of 150 deaths per thousand births to 85 per thousand for both sexes combined. Infant and child mortality continued to decline after 1964--by about 28 percent between 1964 and 1978--so that by 1978 infant mortality was about 64 deaths per thousand births, lower than similar rates in many developing nations. Overall, during the 1950-78 period there has been substantial improvement in the

TABLE 1 Selected Final Child Mortality Estimates by Sex, 1950-78: Colombia

Year	Female		Male	
	Infant Mortality ($_1q_0$)	Probability of Dying by Exact Age 5 ($_5q_0$)	Infant Mortality ($_1q_0$)	Probability of Dying by Exact Age 5 ($_5q_0$)
1950	.1375	.2107	.1619	.2337
1951	.1347	.2072	.1587	.2300
1952	.1294	.2004	.1524	.2227
1953	.1242	.1938	.1464	.2157
1954	.1193	.1874	.1405	.2087
1955	.1145	.1811	.1349	.2020
1956	.1098	.1750	.1294	.1954
1957	.1053	.1690	.1242	.1889
1958	.1010	.1633	.1191	.1827
1959	.0969	.1576	.1142	.1766
1960	.0924	.1522	.1095	.1706
1961	.0884	.1468	.1049	.1648
1962	.0852	.1417	.1006	.1592
1963	.0829	.1367	.0973	.1489
1964	.0813	.1318	.0942	.1442
1965	.0796	.1295	.0920	.1408
1966	.0777	.1268	.0901	.1375
1967	.0758	.1215	.0875	.1329
1968	.0739	.1165	.0849	.1284
1969	.0717	.1124	.0822	.1242
1970	.0691	.1090	.0793	.1201
1971	.0666	.1063	.0765	.1162
1972	.0642	.1038	.0738	.1124
1973	.0619	.1010	.0712	.1087
1974	.0606	.0995	.0693	.1059
1975	.0603	.0993	.0690	.1056
1976	.0600	.0991	.0687	.1053
1977	.0597	.0990	.0684	.1050
1978	.0594	.0988	.0681	.1047

chances of survival of young children: child mortality ($_5q_0$) declined by more than half (about 54 percent for both sexes combined), and in the case of infant mortality the reduction amounted to 57 percent. Nevertheless, despite this improvement, in 1978 the

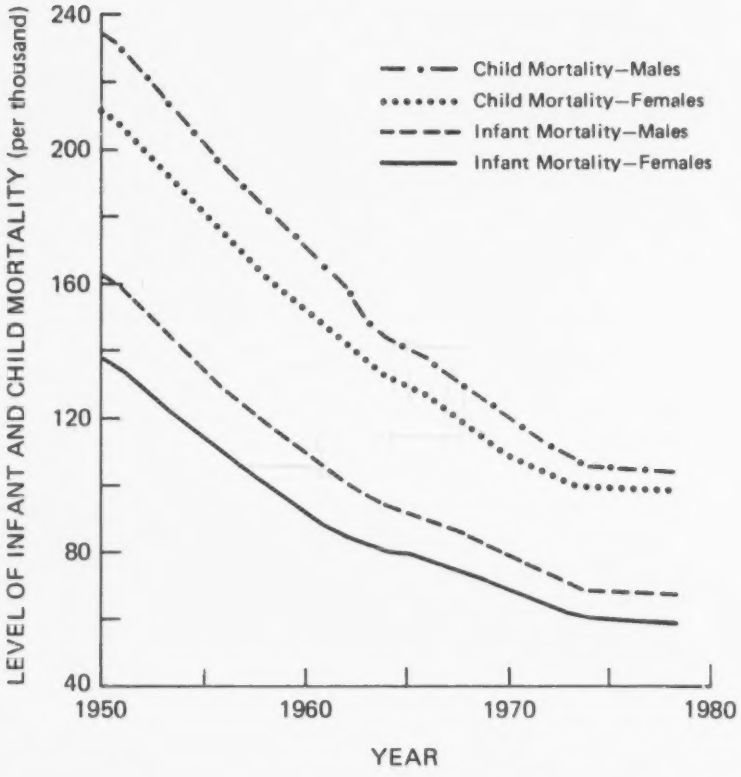


FIGURE 1 Final Estimates of Infant ($_1q_0$) and Child ($_5q_0$) Mortality by Sex, 1950-78: Colombia

Note: Infant mortality is $_1q_0$ x 1,000; child mortality is $_5q_0$ x 1,000.

Source: Table 1.

probability of a child dying before reaching a fifth birthday was close to one in 10. In addition, greater reductions appear to have taken place before rather than since 1964 (infant mortality falling from 150 to 85 per thousand from 1950 to 1964, and from 85 to 64 in the next 14 years).

Adult Mortality

Adult mortality, estimated in terms of the expectation of life at birth (e_0) and at age 5 (e_5), also declined.

During the 1950-64 period the expectation of life at age 5 increased by approximately 10 and 11 percent for males and females, respectively. The estimated values of the expectation of life at birth in 1950 and in 1964 are, respectively, 43.7 and 53.1 years for males and 46.7 and 56.4 years for females.

The estimates of adult mortality for 1964-78 are based mainly on a life table fitted to adjusted age-specific mortality rates obtained from the 1973 census and registered deaths. Since the quality of these data is fairly weak, the accuracy of the estimates presented is also uncertain. Unfortunately, the set of reliable indirect estimates of adult mortality that can be derived from the 1978 National Household Survey data does not refer to the 1970s. Therefore, no external consistency check is possible. Hence, adult mortality estimates for the last decade should be interpreted with caution. They imply that the expectation of life at age 5 increased by 5 and 6 percent among males and females respectively and that the expectation of life at birth in 1973 was 58.1 years for males and 61.7 years for females. The final yearly estimates of adult mortality for the 1950-78 period are presented in Table 2 and Figure 2.

The reasons for the uncertainty surrounding the estimated levels of adult mortality prevalent during the most recent decade are presented in detail in Chapter 2. Evaluation of the main and traditional source of information on adult mortality--the number and age distribution of registered deaths--shows that the age distribution of registered deaths (especially that of males) is severely distorted by consistent exaggeration of the reported age at death. Such distortions, if unchecked, tend to produce underestimates of adult mortality even when allowance is made for some degree of underregistration. A method that redistributes deaths when there is evidence of age exaggeration is used to obtain more reliable estimates of registration completeness. These estimates are reasonably consistent with those obtained on the basis of stable and quasi-stable analysis, a fact that validates them both.

For the 1963-65 period, independent estimates of adult mortality are obtained from the orphanhood and widowhood information gathered by the 1978 National Household Survey. Estimates for females obtained from questions on widowhood posed to males had to be discarded because they implied an unrealistically high e_5, but the other estimates (derived from orphanhood and female widowhood)

TABLE 2 Final Estimates of Expectation of Life at Birth (e_0) and at Exact Age 5 (e_5) by Sex, 1950-78: Colombia

	Female		Male	
Year	e_0	e_5	e_0	e_5
1950	46.74	53.93	43.71	51.75
1951	47.10	54.13	44.05	51.92
1952	47.83	54.55	44.74	52.29
1953	48.56	54.98	45.43	52.65
1954	49.29	55.40	46.13	53.03
1955	50.02	55.83	46.82	53.41
1956	50.74	56.27	47.51	53.80
1957	51.46	56.70	48.20	54.20
1958	52.18	57.14	48.89	54.59
1959	52.89	57.58	49.59	54.99
1960	53.60	58.02	50.28	55.40
1961	54.31	58.46	50.97	55.82
1962	55.01	58.91	51.66	56.24
1963	55.71	59.35	52.37	56.35
1964	56.40	59.80	53.06	56.81
1965	56.75	60.02	53.40	56.98
1966	57.10	60.23	53.73	57.12
1967	57.79	60.63	54.37	57.54
1968	58.46	61.04	55.01	57.96
1969	59.13	61.48	55.64	58.38
1970	59.79	61.97	56.26	58.80
1971	60.43	62.50	56.88	59.23
1972	61.06	63.01	57.49	59.64
1973	61.68	63.48	58.09	60.05
1974	62.26	64.01	58.68	60.51
1975	62.31	64.06	58.74	60.55
1976	62.36	64.10	58.80	60.60
1977	62.42	64.15	58.86	60.64
1978	62.47	64.20	58.92	60.68

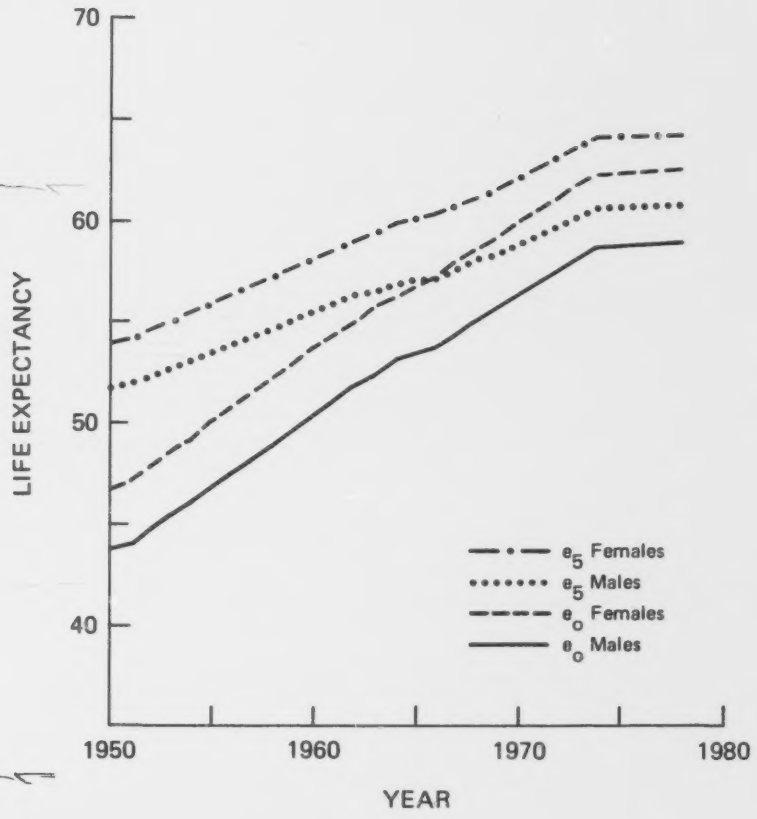


FIGURE 2 Final Estimates of Expection of Life at Birth (e_0) and at Exact Age 5 (e_5) by Sex, 1950-78: Colombia

Source: Table 2.

agree well with those for 1964 derived via quasi-stable analysis.

For 1970 onward, estimates obtained from orphanhood and widowhood information are in general too low (implying a very high e_5) and also had to be discarded. Therefore, the only sources of information that can be successfully exploited in estimating adult mortality during this period are death registration data and the 1973 census. The lack of stability of the population at that time, coupled with the likely distortions present in the age distribution of registered deaths, make the accuracy of the estimates obtained from these sources fairly uncertain. Hence, although a complete yearly

series of life expectancy estimates (e_0 and e_5) is presented for the 1950-78 period (Table 2 and Figure 2), those for the 1970s should be viewed mainly as plausible approximations. According to these estimates, life expectancy at age 5 (e_5) among males increased from 51.8 years in 1950 to 58.8 years in 1970; among females, from 53.9 years to 62.0. Thus life expectancy for females increased slightly more (15 percent) than that for males (13.5 percent). By 1978 the tentative estimates show male life expectancy at age 5 to be just above 60 and female life expectancy to be around 64.

The estimates of life expectancy at birth (e_0) show greater improvements during the past three decades (males from 43.7 to 58.9 years and females 46.7 to 62.5 years between 1950 and 1978) because of the substantial contribution of reduced infant and child mortality to e_0. For this reason, the analysis of trends in adult mortality in Chapter 2 concentrates on constructing and comparing estimates of e_5.

Fertility

The available estimates of fertility indicate that it remained fairly constant up to 1964 or 1965, with a total fertility rate of 6.7 or 6.8 children per woman, and started to decline thereafter. The exact path followed by fertility as it declined cannot be determined, but it has been modelled by a simple linear trend, with the total fertility rate falling from about 6.8 in the mid-1960s to 5.1 to 5.2 children per woman in 1973 and then to a level of 4.2 by 1978. The yearly estimates, shown in Table 3, imply that total fertility decreased by nearly 40 percent within 15 years. Figure 3 presents age-specific fertility schedules for selected years during the 1965-78 period.

The decline in terms of birth rates is somewhat smaller (of the order of 34 percent) than that in total fertility, but it is still very impressive. The birth rate declined from about 47 in 1964 to about 31 in 1978 (see Table 4). It must be pointed out, however, that in 1978 the Colombian population was still growing at a rate of nearly 2.2 percent (disregarding migration) and that its birth rate was still 31 births per thousand. The birth rate has been greatly reduced and population growth has decelerated, but the population is still increasing rapidly.

TABLE 3 Total Fertility Estimates Implied by the Fitted Trend Line, 1964-78: Colombia[a]

Year	Estimated Total Fertility
1964	6.80
1965	6.62
1966	6.43
1967	6.25
1968	6.07
1969	5.88
1970	5.70
1971	5.52
1972	5.33
1973	5.15
1974	4.97
1975	4.78
1976	4.60
1977	4.42
1978	4.23

[a]The trend line is shown in Figure 16.

These declines in fertility have occurred as the use of contraception increased. Whereas in 1969 only about one-third of ever-married women reported having ever used contraception, the 1976 Colombian Fertility Survey showed that ever-use among this group had increased to 59 percent (69 and 41 percent in urban and rural areas respectively). The more important measure, current use, measured in the 1976 survey as use among nonpregnant, currently married women without a fecundity impairment, was in that year almost twice as high in urban areas (60 percent) as in rural areas (34 percent). The 1978 Contraceptive Prevalence Survey showed prevalence at 52 percent among currently married (defined as cohabiting) women, and 62 and 35 percent in urban and rural areas, respectively. (Preliminary results from the 1980 Contraceptive Prevalence Survey show similar prevalence rates.)

As in the case of child mortality, most of the data relevant to estimating fertility were gathered during the 1970s. Therefore, a detailed examination of the evidence

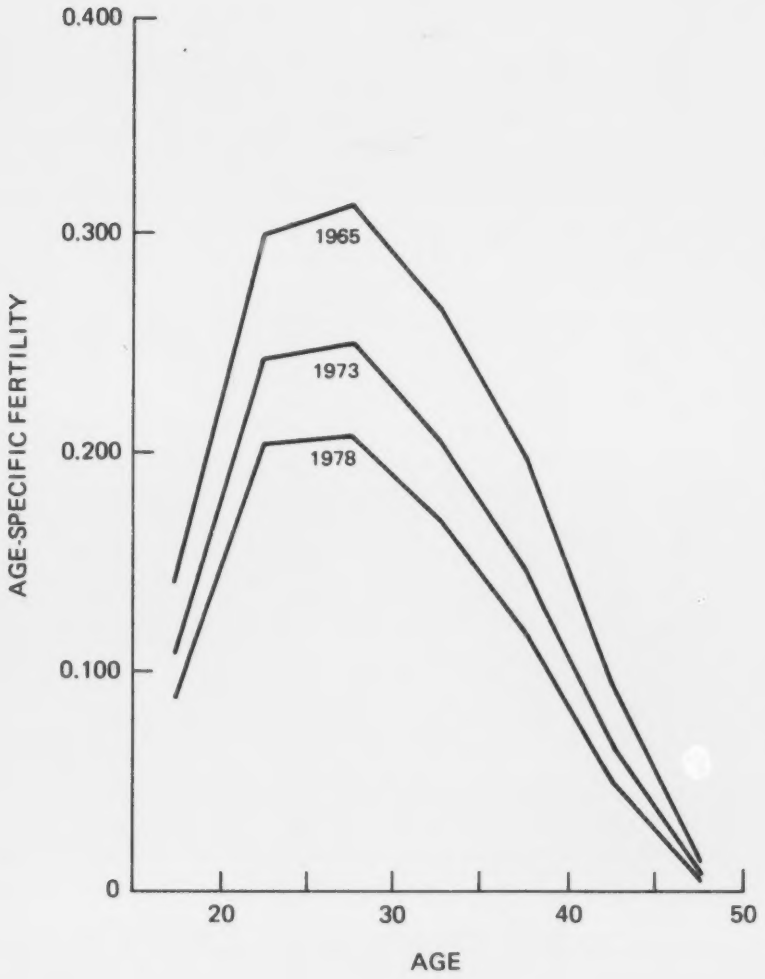


FIGURE 3 Fitted Age-Specific Fertility Schedules for 1965, 1973, and 1978: Colombia

Source: Table 86.

yields relatively reliable fertility estimates only for the 1964-78 period. This examination is presented in Chapter 3. The 1973 census sample and several other sample surveys constitute the main sources of fertility information. Each source is examined for internal consistency as well as for consistency with other sources. In general, the agreement between the different sources is high, although not perfect. Only one source, the 1969

TABLE 5 Regions Used for Demographic Analysis: Colombia

	Birth Rate (per thousand)		
Year	Male	Female	Both Sexes
1964	.0476	.0462	.0469
1965	.0466	.0452	.0459
1966	.0450	.0437	.0444
1967	.0436	.0423	.0430
1968	.0422	.0410	.0416
1969	.0409	.0397	.0403
1970	.0397	.0385	.0391
1971	.0385	.0373	.0379
1972	.0374	.0362	.0368
1973	.0363	.0352	.0357
1974	.0353	.0342	.0347
1975	.0343	.0332	.0338
1976	.0333	.0323	.0328
1977	.0324	.0314	.0319
1978	.0315	.0306	.0311

Note: Sex ratio at birth = 1.034.

National Fertility Survey, had to be rejected as consistently biased.

Although none of the estimates presented above should be interpreted strictly as "the" estimate, the overall magnitude of the fertility decline they imply is probably correct. Uncertainties remain, however, about when the decline started and about the exact trend it followed. The linear trend fitted seems acceptable, as does the assumption that fertility had remained constant prior to 1964. However, although the available evidence does not invalidate these assertions, it cannot confirm them with certainty.

In conclusion, the demographic profile of Colombia during the last decade can be fairly well established in terms of fertility and child mortality, but solid estimates of adult mortality are still lacking. It is hoped that the data on orphanhood and widowhood gathered by recent surveys may soon dispel the uncertainties remaining in this area.

1

INTRODUCTION

1.1 GENERAL CHARACTERISTICS OF THE COUNTRY

Located in northwest South America, Colombia is the only South American country with a substantial coastline on both the Atlantic and Pacific oceans. It has territorial borders with Panama to the west, Venezuela and Brazil to the east, and Ecuador and Peru to the south. Its total territory occupies approximately 440,000 square miles. This territory is divided into three types of major administrative units: departamentos, intendencias, and comisarias. The departamentos enjoy the greatest political autonomy and correspond to the most developed areas of the country. The intendencias and comisarias, often referred to collectively as the territorios nacionales (national territories), encompass larger, less-developed areas with low population density. Their fiscal and administrative autonomy is more limited than that of the departamentos. Each of the major administrative units is in turn subdivided into municipios. The municipio is the basic administrative unit and has considerable autonomy.

At present, Colombia is divided into 22 departamentos, 5 intendencias, 4 comisarias, and a distrito especial (special district) that contains the capital city, Bogota. For the purposes of demographic analysis, the 22 departamentos and the distrito especial are often grouped into the five regions shown in Table 5 and the map of Colombia.

In geographical terms, Colombia consists roughly of two regions: the humid, torrid plains of the southeast and the lofty Andean ranges of the northwest. Administratively, these regions correspond approximately to the national territories and the departamentos, respectively. Jungle lowlands make up about three-fourths of the

TABLE 4 Estimated Crude Birth Rates by Sex, 1964-78: Colombia

Region	Departamentos
Atlantic	Atlantico
	Bolivar
	Cesar
	Cordoba
	La Guajira
	Magdalena
	Sucre
Pacific	Cauca
	Choco
	Narino
	Valle de Cauca
Central	Antioquia
	Caldas
	Huila
	Quindio
	Risaralda
	Tolima
Eastern	Boyaca
	Cundinamarca
	Meta
	Norte de Santander
	Santander
Bogota	Bogota, Distrito Especial

country's area. The continental national territories alone comprise about half of the nation's land. They extend over a vast plain dissected by navigable rivers, which are tributaries of the Orinoco and Amazon systems. North of them (at Meta) lie the savannas (llanos) used for cattle and sheep grazing.

Due to their climate, the national territories have never attracted big population settlements. According to some estimates and the preliminary count of the 1973 census, only slightly over 2 percent of the country's

Source: Adapted from U.S. Bureau of the Census (1979).

population lived in the national territories (DANE, 1974a and 1974b). In contrast, the higher plateaus and valleys interspersed among Colombia's mountain ranges have traditionally been settlement sites. The Central and Eastern regions contain most of these sites. As of 1973, 48 percent of the nation's population inhabited these regions, and an additional 14 percent lived in the distrito especial, the capital city's metropolitan area located at the heart of the Eastern region.

The population has also been attracted to the lowlands flanking the oceans, which are located primarily in the Pacific and Atlantic regions. According to the 1973 preliminary census count, approximately 36 percent of the country's population lived in these two regions, equally divided between the two. The Atlantic region is fairly arid and can support agriculture only when irrigated. The Pacific region, in contrast, has a rainy tropical climate and is endowed with large, fertile agricultural valleys. Cali, Colombia's third largest city and an important industrial site, is located in the Pacific region.

The main body of this report describes the demographic characteristics of the Colombian population living in the five regions listed in Table 5. The inhabitants of the national territories usually have been eliminated from the population universe being studied via sample surveys. Hence, there is very little information about this portion of the population. The demographic data described below generally pertain to the other 98 percent of the population.

1.2 DATA SOURCES

The typical sources for demographic data are censuses, vital registration, and sample surveys; Colombia has used all three to gather information about its population. The sections below describe the type and quality of data produced by each of these typical data sources. (In addition, during the 21-month period from August, 1971 to April, 1973, a dual-record system was operated on an experimental basis in the departamentos of Bolivar and Santander by the Centro de Investigacion sobre Metodos de Estimacion Demografica (CIMED, 1973). However, since the data yielded by this system do not refer to the country as a whole, they are not used in this report.)

1.2.1 Censuses

Colombia has a fairly long history of census taking. During this century, eight censuses have been carried out, but not at regular intervals. The dates and total counts yielded by these censuses are presented in Table 6.

As Table 6 indicates, the results of at least two of the censuses have been sufficiently suspect so as not to be approved by Congress. Among the censuses whose counts were approved, several required a major adjustment of the official population count. In 1918 an upward adjustment of at least 5 percent was incorporated in the official population count (CIMED, 1973). A quotation from the 1928 census report (CIMED, 1973) indicates that a similar adjustment was made in 1928, partly because it was judged necessary to reduce the census's deficiencies and partly to ensure comparability with previous censuses for which the same practice had been adopted. Table 7, which shows the average annual intercensal growth rates implied by

TABLE 6 Reference Dates and Official Population Counts for Censuses Since 1900: Colombia

Reference Date	Population
June 15, 1905	4,143,632
March 5, 1912	5,072,604[a]
October 14, 1918	5,855,077
November 17, 1928	7,851,000[a]
June 5, 1938	8,701,816
May 9, 1951	11,548,172[b]
July 15, 1964	17,484,508
October 24, 1973	20,785,235

[a]Census results were not approved by Congress.
[b]Adjusted figure.

Sources: 1905 to 1964: CICRED (1974:22); 1973: DANE (1981).

TABLE 7 Annual Intercensal Growth Rates Implied by Official Census Counts, 1905-73: Colombia

Intercensal Period	Length of Intercensal Interval (years)	Average Annual Growth Rate (per thousand)
1905-12	6.73	30.1
1912-18	6.61	21.7
1918-28	10.09	29.1
1928-38	9.55	10.8
1938-51	12.92	21.9
1951-64	13.19	31.5
1964-73	9.27	18.7

the census counts shown in Table 6, indicates that the 1928 census results were clearly overinflated.

In 1938, apparently to avoid rejection by Congress, the census count was not adjusted at all, although it was believed to be an underestimate of the country's true population size. In 1951, deficiencies stemming from the failure to enumerate certain communities affected by social unrest were corrected by adding an estimated population of 191,683 to the observed count. This correction implies that the enumeration was thought to have been 98.3 percent complete. The 1964 census results do not appear to have been adjusted before publication.

At the time this report was prepared, the results for the 1973 census were still subject to controversy, since the final count had not yet been published. At present, although definitive results are available (DANE, 1981), there remain some questions about the exact meaning of the published figures. Furthermore, the existence of several different sets of figures labeled "preliminary counts" cannot be ignored. For these reasons Appendix A presents a fairly thorough discussion of the 1973 census, highlighting its scope and limitations.

The 1973 census was the first to gather information on parity, child survival, and date of most recent birth. This information, together with an age distribution, has been published on the basis of a 4-percent sample selected

systematically from census returns (DANE, 1975a). Although the 4-percent probability of selection was maintained during the whole sampling process, at the point of expanding the data a somewhat higher weight was given to the population of Bogota (28 instead of 25) to allow for the fact that its population was differentially underenumerated.

1.2.1.1 *Completeness of Coverage*

PES Estimates of Completeness. Because none of the Colombian censuses can be considered entirely accurate, efforts have been made to estimate the completeness of coverage of the two most recent censuses via post-enumeration surveys (PES). In 1964 a PES was carried out by DANE in the six largest cities (Bogota, Cali, Medellin, Barranquilla, Barrancabermeja, and Cartagena) and in seven others selected on the basis of population size. The PES took place three months after the census, and according to its results and to other available information (including a preliminary urban count carried out three months before the census, the list of heads of household made in rural areas in preparation for the census, and the results of the agricultural census), DANE concluded that the 1964 census count was 98.2 percent complete (DANE, 1967). The completeness estimates derived from analytical techniques (see below) suggest that this estimate is somewhat optimistic, probably because completeness of enumeration was greater in urban areas.

A post-enumeration survey to check the census results was also planned for the 1973 census. However, due to field problems associated with the census operation, it did not take place until October 1974, on the occasion of the eighth round of the National Household Survey (DANE, 1977a). This PES covered only the population in private dwellings of the departamentos and Bogota. Therefore, the undercount estimate it produced referred only to these components of the census count (see Appendix A). According to DANE (1977a), a "field" estimate of census coverage in the departamentos and Bogota was obtained by a combination of two procedures: the PES itself and cartographic checks used to identify areas in 14 cities that were known not to have been enumerated on the census date. These procedures produced a final estimate of census coverage of approximately 93 percent: 94 percent in the cabeceras and about 90 percent in the other areas of the departamentos (DANE, 1981).

Based on these estimates, DANE inflated the figure for the population in private households of the departamentos. However, in the DANE (1977a) publication, the inflation factor was incorrectly applied to a base population count that included both the Indian population in the Cauca reservations (to which the PES results do not apply) and the adjusted population of Bogota (which already reflected an 11-percent undercount for the city). Hence, the final population estimate of about 23 million published in DANE (1977a) may be too high.

The correctly inflated results were published in DANE (1977c) and were adopted for some time as the official adjusted 1973 census count, amounting to 22,551,811 inhabitants. However, this total did not include the persons serving in the armed forces (see Appendix A) and no adjustment was made to the population living in the Indian reservations. In the final census report (DANE, 1981), the revised adjusted count is 22,915,229, implying an overall completeness of coverage of about 90.7 percent in comparison to the final, unadjusted 1973 census count shown in Table 6. Table 8 shows the decomposition of the adjusted count into its main components (see Table A.2 for the unadjusted equivalents).

Analytical Estimates of Completeness. In addition to PES-based estimates of coverage, several analysts have used other techniques to estimate the true population on the census dates. Lopez (1968) and Arevalo (1968), among others, have made extensive evaluations of the 1951 and 1964 censuses. Using techniques based on stable and quasi-stable population theory, Lopez concluded that the population under 10 in 1964 was underenumerated by about 4 percent and that males aged 15-44 were underenumerated by some 6 percent. His final adjusted estimates of the population, in terms of totals and age distribution, is similar to that proposed by Arevalo, who used intercensal comparisons to assess the relative coverage of the 1938, 1951, and 1964 censuses. The latter assumed that the 1938 count was correct and used a 1951 population that does not include the Indian and tribal count nor the 1.7 percent adjustment for underenumeration that was included in the official 1951 figure (see Table 6). Table 9 summarizes Arevalo's results. According to them, the 1964 census achieved higher completeness of coverage than the 1951 census, and in both censuses females appear, overall, to have been more completely enumerated than males.

TABLE 8 Adjusted Results of the 1973 Census: Colombia

Type of Population	Count	Total
Departamentos		19,261,772
Private households	17,147,984	
Adjustment to private households	1,770,612	
Collective households	343,176	
Bogota		2,861,913
Private households	2,530,467	
Adjustment to private households	290,365	
Collective households	41,081	
National territories	375,000	375,000
Armed forces	53,111	53,111
Indian population in reservations (not in national territories)	363,433	363,433
Total		22,915,229

Source: DANE (1981).

For 1973, several analysts have proposed alternative estimates of census coverage based on some version of the components method in which estimates of fertility, mortality, and migration are used to project the 1964 population to 1973. Therefore, differences among the various estimates arise from differences in the 1964 population used as a base and differences in the estimates of fertility, mortality, and migration used. Table 10 presents both DANE's completeness estimate (1977c), based on the PES results, and some of the estimates based on analytical techniques.

In deriving completeness estimates by the components method, the estimates of net migration used are the crudest, due to the paucity of data on that subject. The

TABLE 9 Arevalo's Estimates of Completeness of Census Counts, 1951 and 1964: Colombia

		1951 Census			1964 Census		
Sex	Age	Raw Count (thousands)	Estimated Count[a] (thousands)	Completeness (percent)	Raw Count (thousands)	Estimated Count[a] (thousands)	Completeness (percent)
Both	All	11,229	11,910	94.3	17,485	18,090	96.7
	Under 10	3,436	3,801	90.4	5,886	6,188	95.1
Male	All	5,579	5,954	93.7	8,615	9,009	95.6
	Under 10	1,746	1,910	91.4	2,981	3,132	95.2
Female	All	5,649	5,959	94.8	8,870	9,081	97.7
	Under 10	1,691	1,893	89.3	2,906	3,056	95.1

[a]Arevalo's adjusted 1951-64 growth rate was used to calculate population estimates for the exact census date.

Source: Arevalo (1968).

TABLE 10 Estimates of the Total Population on October 24, 1973, and Corresponding Estimates of Census Coverage: Colombia

Source	1973 Estimated Population, Excluding Migration	1973 Estimated Population, Including Migration	Percent Completeness of 1973 Census Coverage[a]
A. Based on the post-enumeration survey[b]			
DANE (1977e)	--	22,552	92.2
B. Based on analytical techniques			
Bayona (1977a)			
High	24,044	23,444	88.7
Low	23,339	22,739	91.4
Departmento Nacional Planeacion (1977)	23,773	22,233	93.5
Pierret (1979)	22,603	22,303	93.2
Potter and Ordonez (1976)	23,201	22,901	90.8
U.S. Bureau of the Census (1979)	--	23,241	89.4

[a]The base population used to estimate census coverage is that in Table A.1: 20,785,235.

[b]Two other such estimates, Gonzalez (1976) and DANE (1977a), have been excluded because they incorporate an overadjusted household population. (Bogota's population was adjusted twice.)

Additional source: Ochoa and Pardo (1979:11).

generally accepted estimates of intercensal migration during the 1964-73 period are those of Arbalaez (1977), who estimated that Colombia had lost 556,683 inhabitants. Arbalaez considered this figure a minimum estimate of migration and suggested that the true amount might be closer to 600,000. Bayona, the Departamento Nacional de Planeacion (DNP) and the U.S. Bureau of the Census (USBC) used estimates of migration borrowed from Arbalaez's results. These estimates are: Bayona, 600,000; USBC, 556,683; and DNP, 540,000. Other authors (Pierret, 1979; Potter and Ordonez, 1976) used 300,000 as a conservative estimate.

For the 1964 base population, Bayona and the USBC used that estimated by Arevalo (18,090,000), DNP used 17,905,000, and Pierret used 17,805,000 (consistent with a 1.8 percent underenumeration in 1964). Potter and

Ordonez used a 1964 population adjusted by smoothing irregularities in the observed sex ratios, hence their 1973 completeness estimates are relative to the completeness of enumeration of the female population in 1964.

In general, the fertility and mortality estimates used by all the analysts seem reasonable, but Bayona's high and low population estimates illustrate how differences of approximately 5 years in the estimated expectation of life and of 0.3 children in the total fertility estimates on which they are based may lead to a difference of about 705,000 persons in the total estimated count.

If the 92.2 percent estimate of completeness yielded by the post-enumeration survey is accepted as a maximum, the DNP and Pierret estimates of total population seem somewhat low. Among the remaining estimates, it is not possible to select the most plausible without further analysis. They are presented at this stage to serve as a frame of reference and to highlight the fact that, even according to the lowest of them, the 1973 census coverage is no better than 94 percent.

1.2.2 Vital Registration

In 1938, Decree No. 92 instituted a compulsory vital registration procedure, which was never fully implemented. In its absence, incomplete parish registers served as the primary source of demographic information on the occurrence of vital events (primarily births and marriages). Since it is estimated that 95 percent of Colombia's population is Catholic, the proportion of vital events that go unrecorded solely due to religious composition is potentially small. The registration of deaths has not been left entirely to the church. Burial permits, which are required in all instances, may be granted by municipal authorities who report deaths to the statistical officers in their departamentos so that vital statistics may be compiled (DANE, 1964).

In 1968, the 1938 decree was amended by Decree No. 3167, which established a recording system designed to gradually implement an obligatory national civil registration system called Servicio Nacional de Inscripcion (SNI). Its aim is to assign a different identification number to every Colombian so that all records the government keeps on an individual may be easily identified. In its 1975-76 report to Congress, DANE (1976b) reported that the birth registration branch of the SNI system was

already operating in several cities and that preliminary tests had proved it produced better results than the traditional baptismal register. In the 1978-79 report, DANE (1979) claimed that by 1978, SNI was operating in most of the country recording births, marriages, and adoptions, and issuing ID cards.

In general, however, the vital registration data produced by the system so far are too deficient to provide accurate estimates of fertility. In fact, since the institution of SNI in 1968, vital statistics have been published only sporadically. Hence, a complete series of registered deaths and baptisms is available only for the period ending in 1969. DANE (1977d) states that the administrative reform implied by the 1968 decree reduced the vital statistics collection zones from 561 to 81, a change that resulted in a severe deterioration of registration completeness during 1968-69. By 1970, death registration was judged to have regained its previous level of completeness, and the deaths registered between 1970 and 1975 have been published (DANE, 1977d).

Even before the 1968 reform, the statistics yielded by the vital registration system were known to be deficient. In the course of evaluating the 1951 and 1964 censuses, Arevalo (1968) estimated the number of births occurring during the intercensal period. Comparing his estimates with the recorded number of baptisms in the 1949-64 period, Arevalo produced the following estimates of registration completeness: 77.2 percent in 1949-54; 79.7 percent in 1954-59; and 81 percent in 1959-64, or an average estimate of around 79 percent. According to Lopez (1968), the number of births recorded during the 1951-64 period amounted to only 67 percent of the total. The U.S. Bureau of the Census (1979) estimated that birth registration completeness around 1964 and 1973 was 81 percent and 52 percent respectively. Arevalo's five-year estimates show that the baptismal register was showing a slight, though steady improvement with time. The deterioration brought about by the institution of civil registration is evident in the U.S. Bureau of the Census estimates.

As for death registration, Lopez (1968) estimated that deaths were underregistered by about 19 percent during the 1951-64 period, while the U.S. Bureau of the Census estimated underregistration at 23 percent in 1964 and 26 percent in 1973. Taken as a series, these three estimates imply a steady deterioration of the completeness of death registration in the country. However, because different

estimation methods were used, one can argue that Lopez's estimate is not comparable with those obtained by the USBC. Fortunately, Potter and Ordonez (1976) have published a series of comparable estimates for 1951, 1964, and 1971: 87, 88, and 71.5 percent for males and 86.5, 88, and 73 percent for females, respectively. Besides showing a higher completeness level for the earlier period than the Lopez and USBC estimates, the Potter and Ordonez series implies that death registration completeness remained more or less constant between 1951 and 1964 and declined only after the administrative reform of 1968. It is not possible to resolve the discrepancies between these figures at this point. The subject is discussed in more detail in subsequent chapters.

1.2.3 Sample Surveys

During the past two decades Colombia has carried out at least five surveys at the national level to investigate the demographic characteristics of its population. The first, conducted in 1965, was a morbidity survey that incorporated some questions on fertility. The next two, in 1969 and 1976, had as their main objective the measurement of fertility. The fourth, in 1978, was a general demographic survey that explored the main aspects of both fertility and mortality. The fifth, also conducted in 1978, focused mainly on contraceptive behavior, although it incorporated several questions designed to investigate current fertility levels. The sections below describe each survey in some detail.

1.2.3.1 *The 1965 National Morbidity Survey (NMS)*

The NMS was carried out by the Colombian Ministry of Health (Ministerio de Salud Publica, 1968) in collaboration with the Asociacion Colombiana de Facultades de Medicina (ASCOFAME). Its main objective was to gather information on the frequency, severity, causes, and consequences of morbidity and on the availability and use of health services in the country. A few demographic factors were also explored, such as the number of children ever borne by women aged 15 to 54 and the number of births occurring between January 1, 1965, and the time of interview.

Although the NMS was the first survey at the national level to include questions on demographic topics, the data it gathered are fairly limited in nature; they allow, at most, the estimation of fertility. Also, the published tabulations do not permit the application of the consistency tests that a thorough analysis of the results would require. Therefore, the NMS data are not used in this report.

1.2.3.2 *The 1969 National Fertility Survey (NFS)*

The NFS was carried out between January 15 and September 3, 1969, by the Asociacion Colombiana de Facultades de Medicina (ASCOFAME) in collaboration with the Centro Latinoamericano de Demografia (CELADE). Its purpose was to measure at the national level "the knowledge, attitude and behavior of Colombian women with respect to fertility and family planning" (ASCOFAME, 1973a). The survey was divided into two parts: an urban and a rural survey. The urban survey was carried out at ASCOFAME's initiative, the rural survey as part of the Programa de Encuestas Comparativas de Fecundidad en America Latina (PECFAL project) coordinated by CELADE. The questionnaires used in both surveys were quite similar, although not identical. Both included, however, complete pregnancy and nuptiality histories. Questions on desired family size, contraceptive knowledge and practice, and socioeconomic characteristics of the couple were also included.

Effectively, two slightly different samples were drawn for the two surveys. In theory, the rural NFS was to have as its universe all women between the ages of 15 and 49 living in towns with less than 20,000 inhabitants (rural population). In practice, areas with a very low population density (less than 10 inhabitants per square kilometer), or those with poor communication systems, were eliminated from the sampled population. The final sample was drawn from 85 percent of the rural population living in an area covering approximately 25 percent of the country's total territory (a substantial portion of the Pacific region was left out). A detailed description of the sample design used in this survey is presented in Appendix B; a description of the urban sample is also included there. The method used in selecting the urban sample implies that the probability of selecting cities with 20,000 inhabitants or more is determined by the size of their adjacent rural populations. Since the spatial

distributions of the rural and urban populations are different, the urban sample resulting from this selection process is not self-weighting at the national level nor, technically, is it representative of the total urban population of the country. At most, it can be considered representative only of 60 percent of all urban females aged 15 to 49, the 60 percent residing in the cities actually included in the sample: Bogota, Cali, Medellin, Bucamaranga, Cartagena, Cienaga, Carmen de Bolivar, Armenia, and Villavicencio. Moreover, since Bogota, which amounts to approximately 40 percent of the urban areas, is included in this set, the urban sample in fact says little about the rest of the urban sector.

Approximately 6,000 interviews were attempted during the survey (3,000 rural and 3,000 urban). Of these, 91 percent and 86.3 percent, respectively, were successfully completed.

Because of the relatively high level of nonresponse (due to losses or refusals), the rural sample lost its self-weighting quality. The urban sample also lost the self-weighting properties it had within the already restricted universe it represented. To reduce biases associated with this nonresponse, weighting factors based on the distribution of eligible females within the municipios in the sample were used in producing the final survey results (though not consistently). These weights do not, however, adjust for the nonrepresentativeness of the urban sample.

1.2.3.3 *The 1976 Colombian Fertility Survey (CFS)*

Part of the World Fertility Survey program, the CFS was carried out between May 10 and August 10, 1976, by the Corporacion Centro Regional de Poblacion (CCRP) and the Departamento Administrativo Nacional de Estadistica (DANE) in collaboration with the International Statistical Institute. Its main objectives were similar to those of the 1969 survey, but they included also the gathering of data that could be used to evaluate the country's vital statistics and to estimate infant and child mortality (DANE, 1978).

Two types of questionnaires were used in the CFS: a household schedule and an individual questionnaire. The household schedule, which could be answered by any adult household member, included questions on the age, sex, educational attainment, occupation, and marital status of

each household member. In addition, for every woman aged 15 and over, questions were asked about children living at home, children living elsewhere, children dead, and the date (month and year), sex, and survival status of most recent birth.

The individual questionnaire was used [illegible] interview selected respondents among all females aged 15 to 49. The questionnaire included complete pregnancy and nuptiality histories as well as a detailed history of contraceptive use.

The sample used for the CFS is part of the multipurpose Master Sample designed by the Ministry of Health (Ministerio de Salud), using the 1973 census results as the sampling frame. Its sampling universe is defined as the noninstitutional civilian population of Colombia, excluding all inhabitants of the national territories. This population amounts to an estimated 95.1 percent of the country's total population (DANE, 1978). Since the Master Sample has formed the basis of all the remaining national sample surveys discussed in this section, it is described in some detail in Appendix B.

In theory, the design of the Master Sample and of each of its subsamples ensures equal probability of selection for every household. However, because of changes in the sampling frame between 1973 and 1976, when the CFS was conducted, the self-weighting character of the household sample was lost. Expansion factors estimated on the basis of field observations were used to adjust for these changes (DANE, 1978).

The subsample of females selected for individual interviews was, in contrast, a properly self-weighting sample, since a variable sampling fraction was used to select eligible women for interviews. The fractions chosen in each case were designed to restore an equal probability of selection for each eligible woman (DANE, 1978). A total of 9,999 households was covered by the CFS, resulting in 5,685 individual interviews. The completion rates were 97.9 for the household visits and 94.6 for the individual interviews.

It is noteworthy that the completion rates for both parts of the CFS are substantially higher than those achieved in the 1969 NFS, probably because CFS interviewers were instructed to return up to four times to the same household in order to complete an interview, whereas in 1969 the number of visits to the same household was limited to two. Also interesting is the fact that the main single cause of nonresponse in the CFS was temporary absence from the household.

1.2.3.4 *The 1978 National Household Survey (NHS)*

The NHS was carried out between June 12 and July 2, 1978, by the Departamento Administrativo Nacional de Estadistica (DANE) in collaboration with the Population Laboratories of the University of North Carolina (POPLAB). The purpose of the survey was to gather information that would permit the estimation of fertility, mortality, and migration levels.

The topics investigated by the survey included age, sex, relationship to the head of the household, and maternal orphanhood status of every household member; mother's presence in the household for all children under 15; marital status and widowhood of first spouse for all the population aged 15 and over; children living at home, children living elsewhere, children dead, date of most recent birth, place of residence of absent children; and age at first marriage for women 15 and over. Information was also gathered on the deaths occurring during the two years preceding the survey (from May, 1976 to June, 1978).

The survey was carried out on the same subsample of the Master Sample used for the 1976 CFS (see Appendix B). All households found in the segments constituting that subsample were interviewed. Due to changes in the population over time, the self-weighting character of the theoretical design of the sample did not hold. Adjustment factors estimated on the basis of new household listings were used to weight the final results and hence reduce possible biases.

The segments in the sample potentially included 11,138 dwellings. Of these, 841 were empty at the time of the survey and 442 were either nonexistent, had been destroyed, or were placed outside the sample segments proper. Thus, among the remaining 9,855 households that could have been interviewed, 9,448 interviews were actually completed, implying a completion rate of 95.9 percent.

The region with the lowest completion rate was Bogota (92.1 percent), while the largest number of empty dwellings was found in the Eastern region. It is important to note that the 1978 NHS was carried out on exactly the same sample of dwellings as that used for the 1976 CFS. Of course, due to migration and other population changes, both samples are not constituted by exactly the same households. However, since the same dwellings were visited on both occasions, overlap between the two is substantial.

1.2.3.5 *The 1978 Contraceptive Prevalence Survey (CPS)*

The CPS was conducted by the Corporacion Centro Regional de Poblacion (CCRP) and the Ministry of Health in collaboration with Westinghouse Health Systems (CCRP, 1979). The field work was carried out between October 23 and December 17, 1978, with an additional period during the second week of January 1979 "to complete some interviews that had not been possible due to temporary absence of women from their households during the first phase of the field work" (CCRP, 1979:11).

The main purpose of the survey was to study the knowledge and practice of contraception among the Colombian population. A secondary goal was to obtain information on the use of and access to maternal and child care programs in the country. The questionnaire included questions on children surviving, children dead, children ever born, date of most recent birth, and current pregnancy status. Questions on desired number of children, knowledge and use of different contraceptive methods, and use of several health facilities were also included. The marital status, age, educational attainment, and occupation of each woman interviewed was recorded.

The CPS was carried out on the twin sample of that used for the 1976 CFS, so their sample designs are very similar. Variations were introduced only at the final selection stage, when women to be interviewed were chosen among all the eligible ones in a segment. Women aged 15 to 49 were all eligible. A controlled selection procedure based on broad age groupings (15-25 and 26-49) was used in conjunction with sampling fractions that ensured equal probability of selection for each eligible woman to choose a total of 4,090 women for interview. The completion rates for the survey were 93.3 percent in urban areas and 91.4 percent in rural areas, or 92.7 percent overall.

1.3 SUMMARY

This chapter presents a brief overview of Colombia as a country and a detailed description of its main demographic data sources. In the following chapters, data from these sources are examined and used to estimate levels and trends in Colombian fertility and mortality during the past three decades (approximately 1951 to 1977).

2

ESTIMATION OF MORTALITY

2.1 INTRODUCTION

In less-developed countries, a large proportion of the total number of deaths occurs to infants and young children, and infant mortality is of special interest to health administrators. The mortality of the whole population--as indicated by the expectation of life at birth--depends as well on the incidence of deaths among those over five. This chapter deals with deaths in these two segments of life in turn, discussing first infant and child mortality, then adult mortality.

2.2 CHILD MORTALITY

Using vital registration data to estimate infant and child mortality has often proved disappointing. Consider, for example, the problems inherent in estimating the infant mortality rate. Errors in either its numerator (the number of registered deaths among children less than a year old) or its denominator (the number of registered births) lead to a biased estimate. Although it is generally assumed that the underregistration of infant deaths is far greater than that of births--thereby producing an underestimate of infant mortality--this assumption does not hold in all cases. In Colombia, where births have been said to suffer from as much as 33-percent underregistration in 1951-64 (Lopez, 1968:68), every possibility must be explored.

When estimates derived from vital registration cannot be trusted, the use of survey data becomes mandatory. The simplest type of data gathered via sample surveys are the number of births and infant deaths (deaths of children

under age one) occurring during some period preceding the survey (one year is the usual interval). This type of data, essentially an analog of vital registration data, has generally proved to be as disappointing as the one it mimics. In most cases, the infant mortality estimates it yields are too low.

A second type of survey data has been by far the most successful in yielding acceptable estimates. This is data on the number of children ever born and the number of children surviving, classified by age of mother. Brass (1964) developed the first technique designed to derive life table estimates from the observed proportions of children dead. At present, several variations and extensions of his method are available.

A third type of survey data is information obtained from detailed fertility histories. These data are in some ways ideal for estimating infant mortality. Potentially they allow mortality to be estimated for selected subgroups, such as birth cohorts, children born to women of a given age, etc. However, they may be affected by the usual errors present in fertility histories, such as the displacement and omission of events, especially those events (early deaths) that are most relevant for estimating child mortality.

In Colombia, all three types of survey data have been gathered at various times. Therefore, it represents an ideal test case for comparing the performance of the main estimation methods available.

2.2.1 Estimates Derived from Fertility Histories

Two of the national surveys carried out during the past decade, the 1969 National Fertility Survey (NFS) and the 1976 Colombian Fertility Survey (CFS), have gathered fertility histories.

The estimation of child mortality from fertility history data is fairly straightforward when the necessary tabulations are available. It usually involves only the careful accounting required to match events and population at risk. For this reason, estimates derived in this way are classified as "direct," since they do not depend on constraining assumptions about mortality or fertility patterns and trends. An excellent account on how to derive child mortality estimates from fertility history information can be found in Somoza (1980). His detailed

analysis of the 1976 CFS serves as a basis for the discussion presented in this section.

2.2.1.1 *Estimates from 1969 NFS Data*

Since the main goal of the NFS was to estimate fertility, use of its data to estimate mortality has not attracted much attention. From the published tabulations it is possible to make direct estimates of infant mortality, either by age of mother or by time period, for rural areas only. The equivalent data for urban areas are not available.

Table 11 displays two sets of $_1q_0$ estimates by time period obtained from the NFS data. The first is based on data for all women, that is, all the available data were used. However, as earlier and earlier dates are considered, the deaths reported are increasingly limited to deaths of children born to younger women (only women aged 15 to 49 in 1969 were interviewed). Hence, $_1q_0$ estimates for earlier periods are based only on the experience of children born to younger women since, for example, the oldest women in the 1969 sample were 30-34 in 1954. To make the infant mortality estimates strictly comparable, a second set of estimates was generated using only data for women under 35 at the time of the child's birth.

From 1954 on, these estimates show a declining trend. The value for 1949-53, however, seems too low, implying an increase in infant mortality between the early and

TABLE 11 Direct Estimates of Infant Mortality for Different Time Periods, Rural Areas, from the 1969 NFS: Colombia

	Using Data for All Women		Using Data for Women Under 35	
Period	$_1q_0$	Number of Births	$_1q_0$	Number of Births
1949-53	.1000	1,436	.1000	1,436
1954-58	.1096	2,161	.1086	2,015
1959-63	.0735	2,750	.0708	2,331
1964-68	.0675	2,644	.0642	2,142

Source: ASCOFAME (1973b:21, 25).

late 1950s. Not only is such an increase implausible, but it is also evident from the data on reported births that older cohorts show a marked tendency to underreport their fertility. For example, the cohort born in 1919-23 reported a cumulated fertility of only 6.18 children by age 40, while the cohort born in 1929-33 reported 7.07 children on average by the same age. Since the $_1q_0$ estimate for 1949-53 depends mainly on data for older cohorts, its low value is probably due to failure to report dead children.

The estimates in Table 11 were obtained directly from the published tabulations of the 1969 NFS (ASCOFAME, 1973b). This source indicates that no weights were used in producing the estimates. Recall, however, that the rural sample of the NFS was designed to be self-weighting. Hence the weights calculated to account for the level of nonresponse encountered in the field are very close to one. Therefore, their use in tabulating the data is not expected to alter the final results substantially. Consequently, the differences between the estimates presented in Table 11 and another set calculated from the same data are surprising. The other estimates, calculated by Bayona (1975) while exploring the relationship between infant mortality rates and other demographic and socio-economic variables, are shown in Table 12. Unfortunately, the time periods used by Bayona do not coincide exactly with those originally used in tabulating the data. Nevertheless, it is evident that Bayona's estimates are not consistent with those derived from the published tabulations. The differences between the two sets are especially disturbing since they are unlikely to be

TABLE 12 Rural Infant Mortality Rates Estimated by Bayona from the 1969 NFS: Colombia

Period	$_1q_0$
1940-49	.123
1950-59	.116
1960-68	.079

Source: Bayona (1975:6).

accounted for by the use of the published weights (ASCOFAME, 1973a). Lack of access to the original survey results prevents us from establishing the cause of these discrepancies. We can only add that, due to its strictly decreasing trend with time, Bayona's set seems more plausible.

2.2.1.2 *Estimates from 1976 CFS Data*

Somoza's analysis of the 1976 CFS data (Somoza, 1980) reveals much about the child mortality estimates derived directly from the CFS fertility histories. In particular, it confirms that the overall pattern of mortality implied by the estimates is plausible (it is similar to that observed in other populations with acceptable data); that infant mortality increases as the age of the mother at the time of the survey increases; that the children of women with little or no education experience higher infant mortality than do children of more educated women; that the variation of infant mortality with respect to mother's age at the birth of the child is similar to that observed in populations with good data (children born to young mothers--under 20--and those born to older ones--over 30--have a higher probability of dying before their first birthday); that male infant mortality is higher than female infant mortality; and that mortality among children whose mothers live in rural areas is higher than among those born to women living in urban areas.

Given the detailed information contained in fertility histories, the data lend themselves to constructing a fairly good picture of the evolution of infant and child mortality during the 30 or 35 years preceding the survey. Somoza's estimates of the mortality experienced by different birth cohorts are shown in Table 13.

Because of essentially the same time reference, the $_1q_0$ value for the 1960-67 cohort according to the 1976 CFS (.0786) can be compared to that for the 1959-68 period yielded by the 1969 Rural NFS data (.0705). If both estimates were correct, this comparison would imply that urban areas in 1960-67 had a much higher infant mortality than their rural counterparts. Although this is possible, the differential usually runs in the other direction, as in the recent experience of less-developed countries. In fact, as shown in Table 14, the CFS data indicate that infant mortality is higher in rural (.0920) than in urban areas (.0722). Unfortunately, the CFS

TABLE 13 Probabilities of Dying Between Birth and Exact Age x ($_xq_0$) for Different Birth Cohorts from the 1976 CFS: Colombia

	Birth Cohort		
Age x (years)	1941-59	1960-67	1968-76
1/12	.0491	.0399	.0323
3/12	.0631	.0496	.0415
6/12	.0814	.0621	.0515
1	.1074	.0786	.0668
2	.1372	.0982	.0843
5	.1609	.1190	.1037
10	.1726	.1277	.1114
Total births	3,425	4,937	6,053
Deaths under age 10	591	627	560

Source: Somoza (1980:16-17).

estimates are based on data for all women and therefore represent the mixed experience of the 1941-76 period. A CFS estimate specifically for the 1959-68 period and for rural areas is not available, making a more appropriate comparison impossible. However, the evidence available does indicate that the published results of the Rural NFS are not consistent with the CFS results. There is much closer agreement between Somoza's and Bayona's estimates for 1960-68: .0786 and .079, respectively. However, since Bayona's estimate refers only to rural areas, its near coincidence with the overall average is also suspect.

2.2.1.3 *Selecting Appropriate Models of Colombian Mortality*

Proper exploitation of data from fertility histories can yield a wealth of information on child mortality. However, one must bear in mind that the women considered become fewer and younger the further one goes into the past. Therefore, given the relationship existing between child mortality and mother's age at the time of birth, estimates for earlier periods may be biased. The direction of this bias, however, is difficult to establish without knowing what the proportion of children born to

TABLE 14 Estimates of Childhood Mortality ($_xq_0$) by Rural/Urban Setting, Individual Interviews from the 1976 CFS: Colombia

Age x	Urban	Rural
1	.0722	.0920
2	.0918	.1160
5	.1086	.1434
10	.1168	.1553

Source: Somoza (1980:34).

women under 25 is during a particular period. If this proportion is relatively small, child mortality estimates based on the experience of women under 33 (as would be those for the 1941-59 birth cohort) would be underestimates, since they would not incorporate the experience of children born to older women.

Bearing this caveat in mind, we use the birth cohort estimates obtained from the CFS to establish which of the four patterns of mortality embodied by the Coale-Demeny model life tables (Coale and Demeny, 1966) is the best model for child mortality in Colombia. Knowledge of the most representative pattern is crucial in the application of indirect estimation methods, as is demonstrated later. (See "model life tables" in glossary.)

Table 15 presents a comparison of the child mortality estimates obtained from all reported births and deaths under age 10 in the CFS and the four model mortality patterns. Each sex and both sexes combined are presented separately. In every case, the level of the model tables chosen as a basis for comparison is consistent with the observed 1(1). The 1(2), 1(5), and 1(10) values corresponding to this level were compared to the observed values by calculating the deviation of their ratio (fitted over observed) from unity. The closer these deviations are to zero, the better the fit. As Table 15 shows, the worst fits are obtained when using the "East" and "South" models, in that order. The "North" and "West" models are better, although neither is perfect. The "West" model yields a closer fit than "North" only for the 1(10) of males and both sexes. In all cases, the

TABLE 15 Comparison of the Childhood Mortality Pattern from the 1976 CFS and the Patterns Contained in Model Life Tables: Colombia

		Model Life Table Regional Family							
	Observed	North		South		East		West	
Age x	$l_0(x)$	$l_N(x)$	$100(\frac{l_N(x)}{l_0(x)}-1)$	$l_S(x)$	$100(\frac{l_S(x)}{l_0(x)}-1)$	$l_E(x)$	$100(\frac{l_E(x)}{l_0(x)}-1)$	$l_W(x)$	$100(\frac{l_W(x)}{l_0(x)}-1)$
Both Sexes									
1	91,900	91,900	0.00	91,900	0.00	91,900	0.00	91,900	0.00
2	89,800	89,989	0.21	90,440	0.71	90,809	1.12	90,270	0.52
5	87,700	87,086	-0.70	89,120	1.62	89,782	2.37	88,624	1.05
10	86,700	85,064	-1.89	88,563	2.15	89,070	2.73	87,578	1.01
Male									
1	91,270	91,270	0.00	91,270	0.00	91,270	0.00	91,270	0.00
2	89,450	89,311	-0.16	89,716	0.30	90,181	0.82	89,647	0.22
5	87,320	86,362	-1.10	88,313	1.14	89,168	2.12	88,017	0.80
10	86,240	84,268	-2.29	87,689	1.68	88,437	2.55	86,965	0.84
Female									
1	92,640	92,640	0.00	92,640	0.00	92,640	0.00	92,640	0.00
2	90,170	90,806	0.71	91,294	1.25	91,564	1.55	91,027	0.95
5	88,030	87,983	-0.05	90,081	2.33	90,532	2.84	89,374	1.53
10	87,150	86,058	-1.25	89,606	2.82	89,846	3.09	88,340	1.37

Note: $l_0(x)$ is the proportion surviving to age x, based on observed data. $l_N(x)$, $l_S(x)$, $l_E(x)$, and $l_W(x)$ are the proportions surviving to age x in the North, South, East, and West families of regional model life tables, with the same l(1) as observed.

Source: Somoza (1980:11, 30).

fit of "North" to 1(10) is off by at least 1 percent. For all 1(x) values under age 10, "North" yields a better fit than "West" for both sexes combined and for females. The fit of "West" to male mortality under age 10 is only marginally better than that obtained by using "North."

Having identified the models that best fit the overall estimates, we can check their performance in fitting more detailed information. Table 16 shows the results obtained when fitting the 1(2), 1(5), and 1(10) estimated values for each of the three birth cohorts considered and for each sex. Again, the level fitted in each case is determined by the observed 1(1). Fits to the estimated 1(10) values are generally poorer, implying that child and adult mortality probably are not well represented by the same model. For this reason, we now focus mainly on mortality up to age 5.

All the panels of Table 16 reveal more or less the same story: the mortality pattern up to age 5 in Colombia has changed from a "West" to a "North" pattern during the past four decades. The "North" model fits extremely well for both sexes of the 1968-76 cohort. However, consideration of each sex separately reveals that the close fit to both sexes combined is obtained by balancing less perfect ones deviating in different directions. In general, female mortality experience up to age 5 has tended to be better represented by "North" than by "West" (if only marginally for the 1941-59 cohort). In contrast, male mortality experience up to age 5 becomes unequivocally "North" only for the 1968-76 cohort.

In assessing these results one must remember that the definition and experience of the cohorts considered are affected by both truncation and censoring. Since only women aged 15-49 in 1976 were interviewed, truncation has its greatest effect on the 1941-59 birth cohort, which is made up mainly of children with fairly young mothers (under 33). Censoring, on the other hand, affects mainly the 1968-76 cohort, whose complete survival experience to age 10 has not yet been observed. Life table estimates are specifically designed to deal with censoring, but no safeguard has been taken to reduce the effects of truncation. Therefore, although a change of pattern from "West" to "North" seems plausible (the reduction of infant mortality brought about by better health services may lead to higher mortality between ages 1 and 4 relative to the reduced $_1q_0$), it may be that this change is just a reflection of the different age distributions of mothers

considered in each case. This possibility does not, however, invalidate the main finding: The pattern prevalent in recent periods is fairly similar to that embodied by the "North" model life tables.

2.2.2 Estimation of Child Mortality Based on the Proportion of Children Dead Among Those Ever Born

In general, indirect techniques for estimating child mortality from data on the number of children ever born and the number surviving have proven fairly successful. In Colombia, the data needed to apply these techniques have been collected at several points in time and by slightly different data gathering mechanisms (a census in 1973 and sample surveys in all other instances); in fact, almost all the surveys described in Chapter 1 have gathered such information. Unfortunately, the required data have been published or are calculable for only a few sources: the 1969 NFS, the 1973 census, the 1976 CFS, and the 1978 NHS.

2.2.2.1 *Estimates Based on 1969 NFS Data*

The 1969 NFS is a source for which the appropriate tabulations have not been published. However, the main report on the survey (ASCOFAME, 1973a) contains a tabulation of women classified by five-year age groups and by number of children ever born and another tabulation of women by five-year age groups and their number of children surviving. Unfortunately, at least two of the classification criteria used (women with 7 or 8 children, and women with 9 or more) lead to uncertainties about the exact number of children born or surviving. In spite of this problem, an attempt was made to estimate child mortality by using approximations to the true data derived from the available tabulations. The estimated raw data are presented in Table 17 and the child mortality estimates obtained from them by using Trussell's method (United Nations, 1982) appear in Table 18.

The set of estimates presented in Table 18 is an expanded version of that usually obtained by applying indirect estimation methods. Ordinarily, the proportion of children surviving among women in a specified age group at the time of the survey is used to derive an estimate of child survival from birth to an age that

TABLE 16 Comparison of Childhood Mortality Patterns by Birth Cohorts and by Sex from the CFS with Model Life Tables: Colombia

		Model Life Table Regional Family			
	Observed	North		West	
Age x	$l_0(x)$	$l_N(x)$	$100(l_N(x)/l_0(x)-1)$	$l_W(x)$	$100(l_W(x)/l_0(x)-1)$
Both Sexes					
1941-59 Cohort					
1	89,260	89,260	0.00	89,260	0.00
2	86,280	86,353	0.08	86,788	0.59
5	83,910	82,215	-2.02	84,434	0.62
10	82,740	79,408	-4.03	83,023	0.34
1960-67 Cohort					
1	92,140	92,140	0.00	92,140	0.00
2	90,180	90,315	0.15	90,588	0.45
5	88,100	87,516	-0.66	89,003	1.02
10	87,230	85,565	-1.91	87,990	0.87
1968-76 Cohort					
1	93,320	93,320	0.00	93,320	0.00
2	91,570	91,904	0.36	92,124	0.61
5	89,630	89,616	-0.02	90,852	1.36
10	88,860	88,017	-0.95	90,010	1.29

Males

1941-59 Cohort					
1	88,050	88,050	0.00	88,050	0.00
2	85,630	84,948	-0.80	85,478	-0.18
5	82,870	80,593	-2.75	83,066	0.24
10	81,630	77,652	-4.87	81,636	0.07
1960-67 Cohort					
1	91,910	91,910	0.00	91,910	0.00
2	90,240	90,180	-0.07	90,478	0.26
5	88,410	87,478	-1.05	88,994	0.66
10	87,390	85,558	-2.10	88,022	0.72
1968-78 Cohort					
1	92,600	92,600	0.00	92,600	0.00
2	91,050	91,102	0.06	91,372	0.35
5	89,150	88,673	-0.53	90,047	1.01
10	88,410	86,942	-1.66	89,162	0.85

Females

1941-59 Cohort					
1	90,550	90,550	0.00	90,550	0.00
2	86,980	87,884	1.04	88,213	1.42
5	85,040	84,006	-1.22	85,941	1.06
10	83,950	81,379	-3.06	84,570	0.74
1960-67 Cohort					
1	92,380	92,380	0.00	92,380	0.00
2	90,120	90,450	0.37	90,680	0.62
5	87,770	87,499	-0.31	88,950	1.34
10	87,040	85,485	-1.79	87,874	0.96
1968-76 Cohort					
1	94,070	94,070	0.00	94,070	0.00
2	92,140	92,738	0.65	92,917	0.84
5	90,150	90,607	0.51	91,690	1.71
10	89,350	89,151	-0.22	90,894	1.73

TABLE 17 Estimated Numbers of Children Ever Born and Surviving, Derived from the 1969 NFS: Colombia

Age Group	Number of Women	Children Ever Born	Children Surviving
Total Country			
15-19	1,321	271	251
20-24	1,106	1,407	1,307
25-29	845	2,415	2,144
30-34	746	3,320	2,938
Urban Areas			
15-19	736	124	112
20-24	633	690	644
25-29	417	1,030	924
30-34	331	1,188	1,083
Rural Areas			
15-19	585	147	139
20-24	473	717	663
25-29	428	1,385	1,220
30-34	415	2,132	1,855

varies with the age of the mother. Data for age group 20-24 yields an estimate of ${}_2q_0$; for 25-29, ${}_3q_0$; for 30-34, ${}_5q_0$; for 35-39, ${}_{10}q_0$; for 40-44, ${}_{15}q_0$; and for 45-49, ${}_{20}q_0$. In Table 18, however, estimates of four mortality parameters (${}_1q_0$, ${}_2q_0$, ${}_3q_0$, and ${}_5q_0$) are shown for each age group of mother. At most, one of these parameters was estimated from the data; this is called a "true" estimate. The remaining ones were derived from the "true" estimate on the basis of the mortality level it implied within the model life table family used (either "North" or "West" on the basis of the findings presented in Section 2.2.1.3.). This mortality level is also presented in the table. Note, however, that a high mortality level in a model life table family indicates low actual mortality. In general, the model used has a relatively minor effect on the "true" estimates yielded by the method (${}_2q_0$ for age group 20-24, ${}_3q_0$ for age group 25-29, etc.). However, its effect on the "translated" estimates, that is, on those derived from the "true" ones solely on the

TABLE 18 Indirect Estimates of Child Mortality from the 1969 NFS: Colombia

Age Group	Reference Date	Mortality Level	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$
Part A. Total Country						
North Model						
20-24	1967.1	18.3	.0597	.0715	.0797	.0913
25-29	1965.4	16.4	.0784	.0966	.1084	.1245
30-34	1963.4	16.9	.0732	.0896	.1004	.1153
West Model						
20-24	1967.0	18.3	.0638	.0748	.0801	.0867
25-29	1965.2	16.3	.0868	.1050	.1133	.1229
30-34	1963.1	16.6	.0833	.1003	.1081	.1173
Part B. Urban Areas						
North Model						
20-24	1967.1	18.7	.0566	.0675	.0750	.0858
25-29	1965.4	17.0	.0727	.0889	.0996	.1143
30-34	1963.4	18.5	.0581	.0695	.0774	.0886
West Model						
20-24	1967.1	18.6	.0604	.0705	.0754	.0815
25-29	1965.3	16.9	.0804	.0965	.1040	.1129
30-34	1963.1	18.1	.0659	.0776	.0832	.0901
Part C. Rural Areas						
North Model						
20-24	1967.1	18.0	.0624	.0751	.0838	.0960
25-29	1965.3	16.1	.0818	.1012	.1136	.1306
30-34	1963.2	16.2	.0807	.0997	.1120	.1286
West Model						
20-24	1967.0	18.1	.0667	.0786	.0843	.0913
25-29	1965.1	16.0	.0909	.1104	.1191	.1293
30-34	1962.9	15.9	.0921	.1120	.1210	.1313

basis of an equivalent level within a given model, is substantial.

When mortality has been declining, the estimated mortality levels associated with different age groups of mother refer to periods progressively in the past. Table 18 includes estimated reference dates for each mortality estimate, which are rough indicators of a time trend when the mortality decline occurred in an approximately linear fashion. (For a detailed explanation on how these reference dates are estimated, see United Nations, 1982).

As expected, the results in Table 18 show that urban mortality is lower than that in rural areas. However, mortality does not appear to be consistently declining; a rise in level between the estimates associated with age groups 25-29 and 30-34 is apparent in almost all cases. This outcome is hardly surprising in light of the approximate nature of the data. In particular, older women are more likely to belong to the cells with an ambiguous or open-ended classification of the number of children (such as "7 or 8" or "9 and more"), so the uncertainty about their number of children ever born and surviving is greater. However, the estimates derived from data referring to younger women (20-24) tend to be associated with relatively high model mortality levels (which indicate lower child mortality), a relationship that would not be expected in view of the known inverse relationship between child mortality and age of mother up to age 30 or so. Furthermore, since the data for women 20-24 are relatively exact (only two of them belonged to the ambiguous categories), the unusually low proportion of children dead cannot be attributed to uncertainties in the data.

One must also note that the data have not been weighted. Therefore, in strict terms, the estimates for the total country (derived from the mere addition of the urban and rural information) are not valid since they incorporate an overweighted rural component. For this reason, one would expect them to be, if anything, somewhat high; however, comparisons with other estimates (presented later) show that this is not the case.

2.2.2.2 *Estimates Based on 1973 Census Data*

Table 19 shows the results of applying Trussell's method to data from the advance sample of the 1973 census. The mortality level estimates show a fairly smooth, declining trend, starting at age group 25-29.

TABLE 19 Indirect Estimates of Child Mortality from the 1973 Census Sample: Colombia

Age Group	Reference Date	Mortality Level	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$
North Model						
20-24	1971.7	17.3	.0698	.0850	.0951	.1092
25-29	1970.0	17.5	.0675	.0819	.0916	.1051
30-34	1967.9	17.3	.0698	.0850	.0951	.1092
35-39	1965.6	17.0	.0724	.0885	.0991	.1138
40-44	1963.1	16.6	.0766	.0941	.1056	.1212
45-49	1960.2	16.4	.0786	.0968	.1086	.1248
West Model						
20-24	1971.6	17.4	.0743	.0885	.0951	.1032
25-29	1969.8	17.4	.0746	.0889	.0956	.1037
30-34	1967.7	16.9	.0793	.0951	.1024	.1111
35-39	1965.2	16.6	.0834	.1004	.1083	.1175
40-44	1962.6	16.1	.0896	.1087	.1173	.1273
45-49	1959.6	15.8	.0931	.1133	.1224	.1329

Note: Since these data have been analyzed by others using either Trussell's method or related ones (Potter and Ordonez, 1976; Behm and Rueda, 1977), it should be noted that differences between the estimates presented here and those obtained by other authors arise mainly for two reasons: (1) Trussell's method has undergone slight modifications, so that the version used here may not be exactly the same as that used before; and (2) the number of women used as denominator here has been estimated by using El-Badry's technique to determine the true proportion of women with not-stated parity (see Table C-1 and Figure C-1 in Appendix C).

Another set of indirect estimates of child mortality based on data from the 1973 census are Palloni's estimates of $_1q_0$ (Palloni, 1979) shown in Table 20. Unfortunately, Palloni produced these estimates for only three of the four Coale-Demeny model patterns of mortality; "North" was left out. The reason given for its exclusion was: "Model North was discarded because it departs substantially from Latin American mortality experience" (Palloni, 1979:462). As the discussion in Section 2.2.1.3 has shown, this assertion is incorrect. However, the lack of reliable "direct" estimates of child mortality in most of Latin America often leads to assertions such as this, which only reflect our general uncertainty about prevalent mortality patterns. The estimates shown in Table 20, based on the "West" model, are very similar to those produced by Trussell's method also based on the "West" model, although Palloni's reference dates are generally

TABLE 20 Palloni's Estimates of Infant Mortality from 1973 Census Data, Using the West Model: Colombia

Age Group of Mother	Indirect $_1q_0$ Estimates	Reference Date
20-24	.0746	1970.3
25-29	.0751	1967.9
30-34	.0791	1965.2
35-39	.0827	1962.0
40-44	.0886	1958.4

Source: Palloni (1979:468).

placed further in the past than the equivalent Trussell estimates.

2.2.2.3 *Estimates Based on 1976 CFS Data*

The third source of information on children ever born and surviving is the 1976 CFS, which also served as the basis for the "direct" estimates presented in Tables 13 and 14. Part A of Table 21 summarizes the results obtained when Trussell's method is applied to the same data. In this case, both mortality models "North" and "West," yield an estimated mortality level for age group 20-24 that is distinctly out of line with the rest. This pattern is often observed in child mortality estimates derived via Brass-type methods from the observed proportions of children dead among women of different age groups, and it is probably due to the fact that child mortality levels are not independent of age of mother. In this report we use the term age-of-mother effect to refer to the influence that age of mother at the time of the birth exerts on the probability of survival of the child.

Biases due to this effect become even more evident when the data considered are classified according to nonstandard age groups (18-22, 23-27, etc.), and a modified Trussell procedure is used to estimate child mortality (Hill et al., 1982). The results obtained using this alternate approach are shown in Part B of

TABLE 21 Indirect Estimates of Child Mortality from Individual Survey of the 1976 CFS: Colombia

Age Group	Reference Date	Mortality Level	1$_0$	2$_0$	3$_0$	5$_0$
Part A. Standard Age Groups						
North Model						
20-24	1974.3	17.0	.0723	.0883	.0989	.1135
25-29	1972.5	17.6	.0665	.0805	.0900	.1032
30-34	1970.4	17.8	.0647	.0782	.0874	.1002
35-39	1968.1	16.7	.0750	.0919	.1031	.1184
40-44	1965.5	16.6	.0768	.0944	.1059	.1216
45-49	1962.6	16.1	.0811	.1003	.1126	.1294
West Model						
20-24	1974.2	17.1	.0771	.0922	.0992	.1076
25-29	1972.4	17.5	.0736	.0875	.0941	.1021
30-34	1970.1	17.4	.0736	.0876	.0942	.1022
35-39	1967.7	16.3	.0865	.1046	.1128	.1224
40-44	1965.0	16.0	.0899	.1091	.1177	.1278
45-49	1962.1	15.5	.0962	.1174	.1269	.1378
Part B. Nonstandard Age Groups						
North Model						
18-22	1974.4	16.2	.0809	.1000	.1123	.1290
23-27	1973.1	18.2	.0607	.0729	.0813	.0932
28-32	1971.5	17.6	.0670	.0813	.0909	.1042
33-37	1969.9	16.5	.0770	.0946	.1062	.1219
West Model						
18-22	1974.4	16.4	.0858	.1037	.1118	.1213
23-27	1973.0	18.1	.0665	.0783	.0840	.0910
28-32	1971.3	17.3	.0751	.0896	.0964	.1045
33-37	1969.7	16.2	.0881	.1067	.1151	.1250

Table 21. According to the nonstandard classification of the data using the "North" model, the estimate derived from age group 18-22 is equivalent to a mortality level a full two levels lower than that associated with age group 23-27; for the "West" model the difference in levels is slightly less than two. Apparently the nonstandard age classification is more successful than the standard one in discriminating mothers whose children have higher-than-

average risks of dying. It also seems to have isolated in age group 23-27 those women whose children have an above-average probability of surviving through the first few years of life. Originally, the use of nonstandard age groups was intended to reduce the effects of age heaping on child mortality estimates. In this case, however, the effects of age heaping seem to be minimal when compared with the biases caused by the age-of-mother effect.

Recall that the CFS included two separate questionnaires: a household section and the individual interviews. The latter are usually considered the CFS proper. However, information on children ever born and surviving was also gathered at the household level and Table 22 shows the estimates obtained using these data. Since the household data refer both to women who were later interviewed individually and to other women not selected for individual interviews, one would expect the estimates it yields to be fairly similar to those obtained from the the individual CFS, as is in fact the case. If anything, the household estimates of ${}_xq_0$ tend to be slightly higher than those derived from individual interviews.

TABLE 22 Indirect Estimates of Child Mortality from Household Survey of the 1976 CFS: Colombia

Age Group	Reference Date	Mortality Level	$1q_0$	$2q_0$	$3q_0$	$5q_0$
North Model						
20-24	1974.3	16.9	.0731	.0893	.1001	.1149
25-29	1972.5	17.5	.0676	.0821	.0918	.1053
30-34	1970.4	17.6	.0667	.0808	.0903	.1036
35-39	1968.0	16.7	.0755	.0926	.1038	.1192
40-44	1965.4	16.3	.0794	.0979	.1099	.1262
45-49	1962.5	16.2	.0801	.0989	.1110	.1275
West Model						
20-24	1974.2	17.1	.0779	.0931	.1003	.1088
25-29	1972.4	17.3	.0749	.0893	.0960	.1042
30-34	1970.1	17.2	.0759	.0905	.0974	.1057
35-39	1967.6	16.3	.0871	.1054	.1137	.1234
40-44	1964.9	15.8	.0930	.1132	.1223	.1327
45-49	1961.9	15.6	.0950	.1158	.1251	.1358

2.2.2.4 *Estimates Derived from the 1978 NHS*

The most recent information available on children ever born and children surviving is that gathered by the 1978 NHS. Part A of Table 23 shows the results of applying Trussell's method to these data using standard age groups. They confirm the findings of the CFS regarding the inverse relationship between child mortality and age

TABLE 23 Indirect Estimates of Child Mortality from the 1978 NHS: Colombia

Age Group	Reference Date	Mortality Level	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$
Part A. Standard Age Groups						
North Model						
20-24	1976.4	17.6	.0661	.0800	.0894	.1026
25-29	1974.6	18.6	.0567	.0676	.0752	.0861
30-34	1972.5	18.0	.0626	.0754	.0842	.0965
35-39	1970.0	17.0	.0721	.0881	.0987	.1133
40-44	1967.3	16.2	.0808	.0999	.1122	.1289
45-49	1964.4	16.3	.0790	.0974	.1093	.1256
West Model						
20-24	1976.4	17.8	.0702	.0831	.0893	.0968
25-29	1974.5	18.4	.0627	.0734	.0786	.0850
30-34	1972.5	17.7	.0712	.0845	.0908	.0984
35-39	1969.6	16.6	.0832	.1003	.1081	.1173
40-44	1966.8	15.6	.0949	.1156	.1249	.1357
45-49	1963.9	15.7	.0937	.1141	.1233	.1339
Part B. Nonstandard Age Groups						
North Model						
18-22	1976.7	18.0	.0624	.0751	.0838	.0960
23-27	1975.3	18.1	.0617	.0742	.0827	.0948
28-32	1973.6	18.0	.0624	.0751	.0838	.0960
33-37	1971.7	17.2	.0702	.0855	.0957	.1098
West Model						
18-22	1976.7	18.2	.0656	.0771	.0827	.0896
23-27	1975.2	18.0	.0672	.0793	.0850	.0921
28-32	1973.4	17.8	.0699	.0828	.0889	.0964
33-37	1971.5	16.8	.0805	.0966	.1040	.1129

of mother (up to age 30): regardless of the model used, the model mortality level associated with age group 20-24 is lower (implying higher child mortality) than that associated with age group 25-29. Furthermore, the mortality level associated with the NHS estimate for the 25-29 age group (18.6) is remarkably high when compared with the 1976 CFS estimate of 17.5 for the same age group. In addition, there are relatively big differences in the NHS estimates between the levels associated with age groups 25-29 (18.6), 30-34 (18.0), and 35-39 (17.0), a feature not seen in any of the previous sets of estimates for standard age groups.

Part B of Table 23 shows the NHS child mortality estimates classified according to nonstandard age groups. They contrast sharply with those obtained from the CFS data (Part B of Table 21), which had greater differences among themselves than did those derived from the same data classified by standard age groups. In the case of the 1978 NHS, the use of nonstandard age groups reduces the differences in levels relative to those observed between the estimates derived from standard groups. This means that the NHS data lend little if any support to the suggestion that mortality is higher among children of young mothers. This contradictory finding suggests that either the relationship between child mortality and age of mother revealed by the 1976 CFS data, and confirmed to a certain extent by the 1973 census (see the "North" estimates in Table 26), is spurious; that age reporting errors are somewhat more prevalent in the NHS survey; or that there is some interaction between a time trend of mortality decline and age of mother.

Consistency of age reporting in the NHS can be assessed by comparing the results obtained from data classified according to reported age with those derived from an age classification based on the reported date of birth. The following two examples illustrate the differences observed between these data sets: (1) The proportion of children dead among the offspring of women 15-19, according to the reported-age classification, is just 79 percent of the equivalent proportion for women classified as being 15-19 according to date-of-birth reports; (2) the proportion of children dead for women 20-24, according to the reported-age classification, is 6 percent greater than the equivalent proportion among women 20-24, according to the date-of-birth classification. Such discrepancies are likely causes of the fairly flat trend displayed by the mortality levels associated with nonstandard age groups.

Hence, at least for younger ages, NHS child mortality estimates are somewhat suspect, due apparently to the influence of age misreporting.

The data on children ever born and surviving in the NHS were gathered for each sex separately, and the resulting mortality estimates by sex are presented in Table 24. These results are interesting because they show that, although in most cases the ${}_xq_0$ value for males is greater than the corresponding one for females, the male mortality level is also usually greater than the one for females, implying therefore that the male-female differentials embodied by the model tables overstate the differentials prevalent among Colombian children. Similar differences are apparent in ${}_xq_0$ estimates for the 1968-76 cohort derived from the CFS fertility histories (see Table 25), so they cannot be ascribed to errors particular to the NHS data.

2.2.3 Estimation of Infant Mortality Based on Registration Data

Table 26 displays estimates of infant mortality for the cohorts born during the periods 1951-68 and 1973-74. These estimates are obtained directly from the numbers of births and deaths registered during the 1951-69 and 1973-75 periods. Registration data are not available for 1970-72. The separation factors used in estimating infant mortality have been calculated directly from the data. (In this case a separation factor estimates the fraction of deaths under one year of age registered in calendar year z which are to births occurring in the preceding year z-1.) They remain very consistent during the 1951-69 period (the only one for which the appropriate data are available), fluctuating around an average value of 0.300 for males, 0.330 for females, and 0.315 for both sexes combined.

2.2.4 Comparison and Assessment of Results

Most of the estimates of child mortality presented in previous sections have been accompanied by the reference date or period to which they apply. In some cases, the reference period encompasses a fairly long time span, thus curtailing the possibilities of detailed comparisons. However, single-year estimates can be constructed by

TABLE 24 Indirect Estimates of Child Mortality by Sex from the 1978 NHS, Standard Age Groups: Colombia

Age Group	Reference Date	Mortality Level	1$_0$	2$_0$	3$_0$	5$_0$
Part A. Females						
North Model						
20-24	1976.4	17.3	.0634	.0781	.0878	.1014
25-29	1974.7	18.2	.0547	.0665	.0744	.0856
30-34	1972.5	18.3	.0543	.0659	.0737	.0848
35-39	1970.1	17.0	.0657	.0812	.0914	.1056
40-44	1967.3	15.9	.0762	.0955	.1079	.1250
45-49	1964.4	15.9	.0764	.0958	.1083	.1254
West Model						
20-24	1976.4	17.3	.0671	.0811	.0877	.0957
25-29	1974.5	18.0	.0602	.0720	.0776	.0845
30-34	1972.2	17.9	.0614	.0736	.0794	.0865
35-39	1969.6	16.6	.0753	.0920	.0998	.1090
40-44	1966.8	15.4	.0888	.1101	.1199	.1312
45-49	1963.8	15.3	.0895	.1111	.1209	.1323
Part B. Males						
North Model						
20-24	1976.4	18.0	.0686	.0818	.0910	.1039
25-29	1974.6	19.0	.0585	.0686	.0760	.0866
30-34	1972.5	17.8	.0710	.0849	.0946	.1080
35-39	1970.0	17.1	.0782	.0946	.1056	.1206
40-44	1967.4	16.4	.0850	.1037	.1159	.1323
45-49	1964.4	16.8	.0810	.0983	.1098	.1254
West Model						
20-24	1976.3	18.1	.0730	.0850	.0908	.0980
25-29	1974.5	18.8	.0648	.0746	.0794	.0856
30-34	1972.2	17.4	.0810	.0953	.1021	.1102
35-39	1969.6	16.6	.0908	.1081	.1159	.1251
40-44	1966.9	15.9	.1003	.1206	.1295	.1397
45-49	1963.9	16.1	.0972	.1165	.1251	.1349

TABLE 25 Mortality Levels Associated with Direct Estimates of Child Mortality for the 1968-76 Cohort from Individual Survey of the 1976 CFS: Colombia

	North Mortality Level	
$_xq_0$	Male	Female
$_1q_0$	17.5	17.7
$_2q_0$	17.4	17.2
$_5q_0$	17.7	16.8
$_{10}q_0$	18.2	17.8

interpolating or extrapolating the period values calculated directly from the fertility history data.

Somoza (1980) has suggested using the logit system (see glossary) generated by the mortality experience of the 1968-76 cohort (see Table 13) as a basis for interpolation. Assuming that Somoza's period estimates presented in Table 27 refer to the midpoint of each period, interpolation within the logit system yields the estimates displayed in Table 28. This series, which will be compared with estimates obtained by other means, will be referred to as the 1976 CFS-Somoza series.

The three panels of Figure 4 plot the major infant mortality estimates ($_1q_0$) presented so far. The indirect estimates shown were all derived via the "North" model. The two sets of estimates represented by horizontal lines spanning periods of several years are those derived directly from the 1969 NHS data. The solid line in all three panels shows the trend derived from the CFS-Somoza series.

On the whole, the CFS-Somoza series seems a fairly good smoothed version of all the other estimates. It is worth noting, however, that from 1960 onward, the CFS-Somoza series falls consistently below the estimates obtained simply from vital registration data. Since the registration data on infant mortality also exceed most of the other estimates displayed for the period 1960-66, it is possible that they overestimate mortality. For example, the estimates obtained from registration data in

TABLE 26 Infant Mortality Estimates Derived from Vital Registration Data: Colombia

Birth Cohort	Both Sexes $_1q_0$	Male $_1q_0$	Female $_1q_0$
1951	.120	.128	.111
1952	.111	.117	.104
1953	.111	.119	.103
1954	.103	.110	.095
1955	.104	.111	.097
1956	.104	.111	.096
1957	.100	.108	.093
1958	.100	.107	.092
1959	.097	.104	.089
1960	.100	.107	.092
1961	.090	.096	.083
1962	.090	.097	.082
1963	.088	.095	.081
1964	.083	.090	.076
1965	.084	.091	.076
1966	.080	.087	.073
1967	.078	.085	.071
1968	.075	.082	.067
1973	.111	.120	.102
1974	.100	.108	.091
1973[a]	.094	.101	.086
1974[a]	.087	.094	.079

[a]Denominators of these rates have been adjusted for late registration of births, i.e., they incorporate the births occurring in those years but registered in subsequent ones (up to 1975).

1973 and 1974 are clearly too high (see Panel 1 of Figure 4).

Estimates derived from the fertility history data of the 1969 Rural NFS are relatively low. Those derived from the printed tabulations and referring to the 1960-70 decade fall below all other estimates for the same period, and Bayona's estimates, although apparently more

TABLE 27 Estimates of Childhood Mortality by Time Period, Individual Interviews from the 1976 CFS: Colombia

Period	$_1q_0$	$_2q_0$
1956-60	.0993	.1273
1961-65	.0782	.1006
1966-70	.0679	.0851
1971-75	.0662	.0837

Source: Somoza (1980:27).

consistent with the rest, are not satisfactory measures of infant mortality for the rural areas of the country.

Estimates yielded by indirect methods applied to 1969 NFS data are a bit higher than the CFS-Somoza series for 1965, but they are lower than the latter for 1963 and 1967. There is remarkable agreement between the CFS-Somoza series and the 1968 and 1970 estimates derived from age groups 25-29 and 30-34 of the 1973 census, but the census estimates based on older age groups (referring to 1966 and earlier) fall consistently below the CFS series. In fact, at these ages, the census estimates approximate fairly well the ones from the 1969 Rural NHS, whose quality is dubious.

Of special importance is the comparison of the CFS-Somoza series with indirect estimates based on the same data (see the CFS-Individual plots in Panel 2 of Figure 4). Since the data base is identical in both cases, one would expect a fairly good agreement between the two types of estimates obtained,[1] which is in fact the case. Differences, however, are evident, and although some can be explained by the age-of-mother effect (for example, on the 1974 estimates), differences observed between the estimates referring to the 1965-70 period suggest that the CFS-Somoza series is too low (see Panel 2 of Figure 4). The age-selective truncation affecting this series is probably one cause of this outcome, but selective omission of dead children may also be responsible.

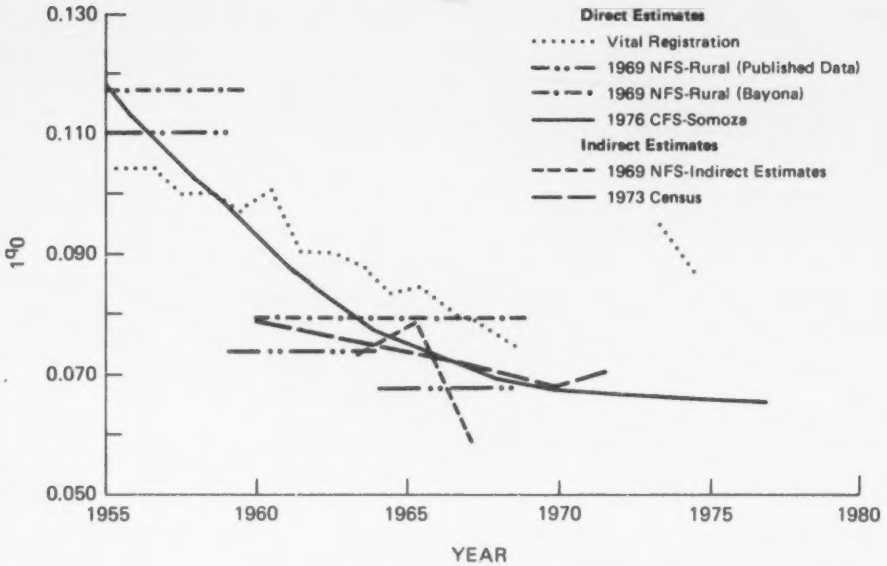
Panel 2 shows clearly that the 1976 CFS estimates derived from data classified by nonstandard age groups emphasize discrepancies, while those derived from the

TABLE 28 1976 CFS-Somoza Series: Child Mortality Estimates for Single Years Derived by Interpolating Between the Estimates Obtained Directly from CFS Fertility Histories: Colombia

	$_xq_0$				
Year	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$
1955	.1170	.1492	.1607	.1850	.1990
1956	.1117	.1428	.1536	.1777	.1905
1957	.1066	.1364	.1468	.1694	.1824
1958	.1017	.1303	.1403	.1619	.1744
1959	.0970	.1244	.1339	.1548	.1668
1960	.0925	.1187	.1279	.1479	.1594
1961	.0882	.1133	.1221	.1412	.1523
1962	.0841	.1080	.1165	.1348	.1455
1963	.0801	.1030	.1111	.1287	.1389
1964	.0771	.0989	.1066	.1234	.1331
1965	.0750	.0957	.1030	.1188	.1280
1966	.0730	.0926	.0994	.1144	.1231
1967	.0709	.0895	.0960	.1102	.1184
1968	.0689	.0866	.0927	.1061	.1138
1969	.0677	.0850	.0909	.1040	.1115
1970	.0674	.0847	.0907	.1038	.1113
1971	.0671	.0844	.0904	.1036	.1112
1972	.0667	.0841	.0902	.1034	.1111
1973	.0664	.0838	.0899	.1032	.1109
1974	.0660	.0836	.0897	.1030	.1108
1975	.0657	.0833	.0894	.1029	.1106
1976	.0654	.0830	.0892	.1027	.1105
1977	.0650	.0827	.0889	.1025	.1104
1978	.0647	.0825	.0887	.1023	.1102

1978 NHS data and classified in nonstandard form are less discrepant than the standard ones. However, relative to the extrapolated 1976 CFS-Somoza series, even the nonstandard 1978 NHS estimates are somewhat low.

Essentially the same conclusions would have been reached if some other indicator of child mortality had been used. Infant mortality was chosen because it is readily available from some data sources (vital registration and the 1969 Rural NFS) while other parameters are not, and thus it permits the largest number of comparisons.



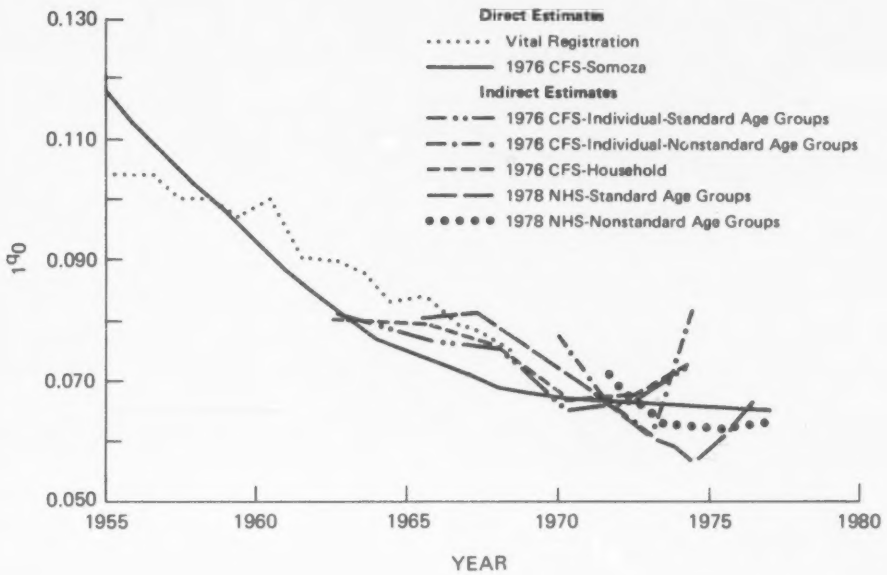


FIGURE 4 Comparison of Infant Mortality Estimates Based on North Model: Colombia

2.2.4.1 *Reassessment of Appropriate Models for Child Mortality*

To explore the effect that the choice of mortality model has on the indirect estimates obtained, $_2q_0$ values derived via the "North" and "West" model have been plotted in Figure 5 along with the direct estimates of the CFS-Somoza series. It is clear from the figure that the use of the "West" model yields overestimates of mortality, since even the indirect 1976 CFS estimates derived from individual interviews (Panel 2) fall consistently above the CFS-Somoza estimates, which were derived from the same data. Therefore, "West" by itself is not an appropriate mortality model for Colombia during the 1962-78 period. This conclusion would hold even if another child mortality parameter had been used.

However, in the earlier discussion of appropriate models for Colombian mortality, "West" emerged as a fairly good representation for the 1941-59 cohort and a reasonable one for the 1960-67 cohort. Furthermore, according to Table 16, for all cohorts the ratio of 1(10) in the "North" model to the observed 1(10) is less than one, while the ratio of "West" to the observed is greater than one. In addition, the deviations of these ratios from unity are fairly similar in magnitude, implying that the average of the "North" $_1l_N(10)$ and the "West" $_1l_W(10)$ is a better approximation to the observed $_1l_0(10)$ than either of them is separately. Note that in deriving $_1q_0$ or $_2q_0$ estimates via indirect methods one is translating not only the estimated 1(10) value into equivalent $_1q_0$ and $_2q_0$ estimates, but also the 1(15) and 1(20) values, and no information is available about the relationship between $_1q_0$, say, and 1(15) or 1(20). Nevertheless, it seems reasonable to translate any 1(x) estimate for $x > 10$ into a $_1q_0$ or $_2q_0$ value by taking an average of the "North" and "West" estimates when dealing with dates prior to 1967. The resulting "revised" $_1q_0$ and $_2q_0$ estimates are shown in Table 29 and the $_1q_0$ estimates are plotted in the panels of Figure 6. These estimates suggest that the 1976 CFS-Somoza series underestimates mortality during the 1962-70 period (see Panel 2), that the NHS estimates referring to periods close to 1978 are somewhat low (see Panel 3), and that the 1973 census estimates still underestimate mortality, although to a lesser extent than before (Panel 1).

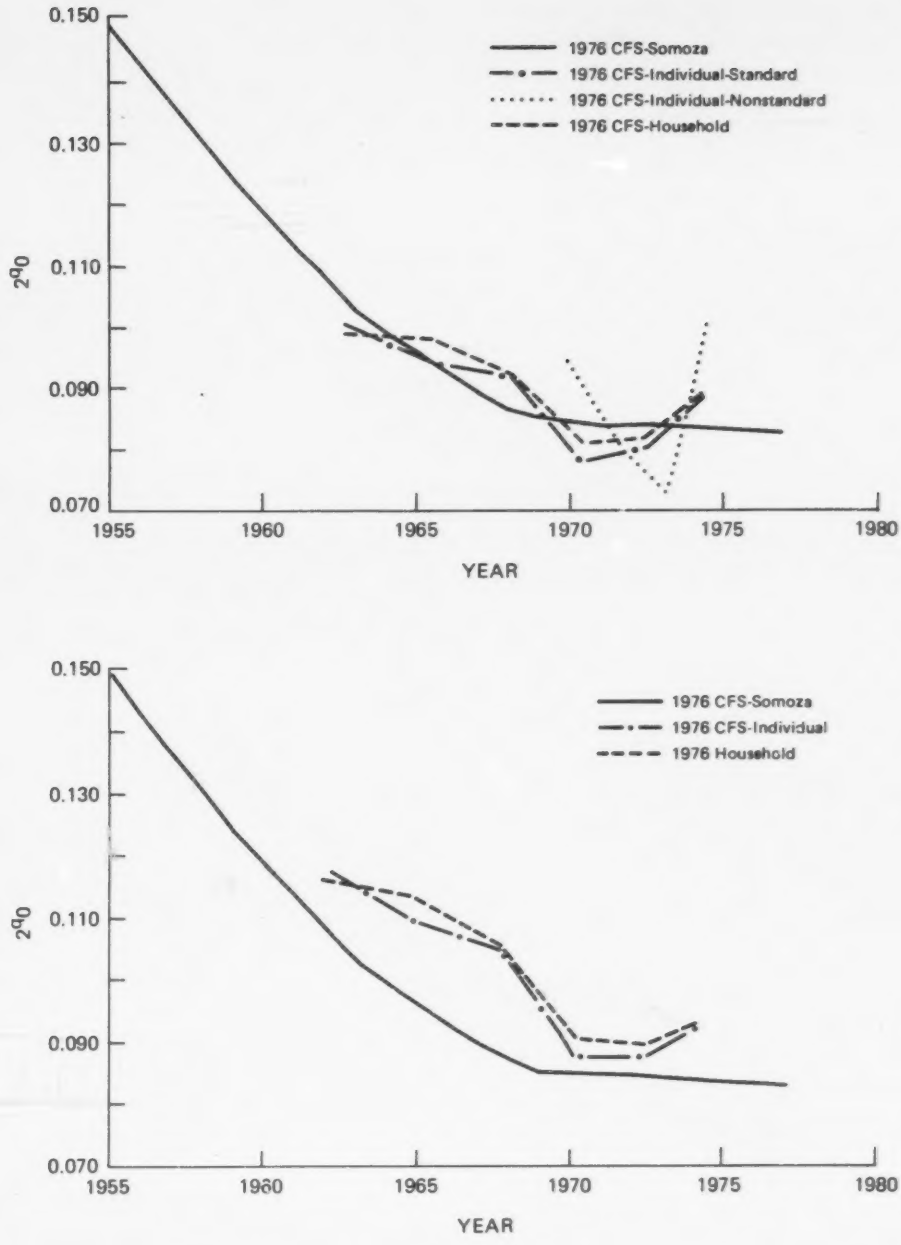


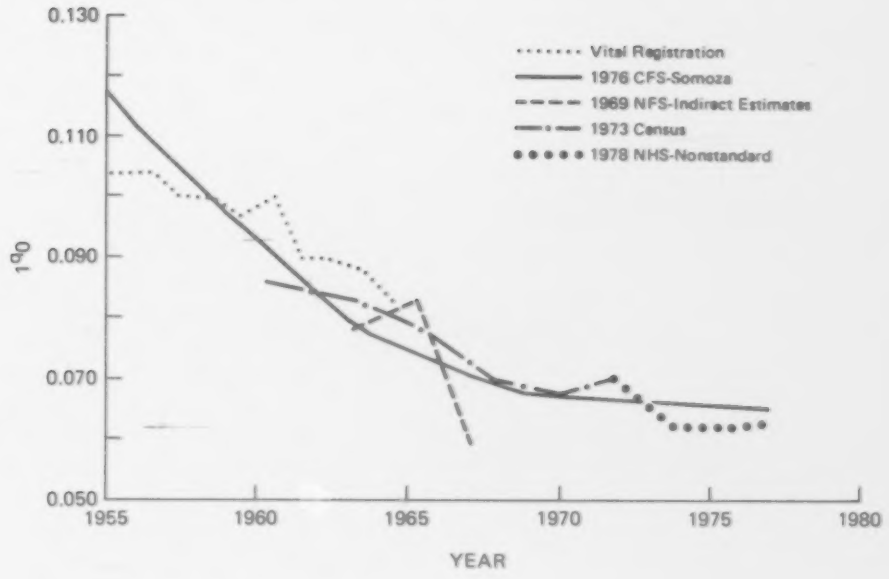
FIGURE 5 Comparison of CFS $_2q_0$ Direct Estimates with Indirect Ones Based on North and West Mortality Models: Colombia

TABLE 29 Revised $_1q_0$ and $_2q_0$ Estimates (Averaging North and West Models for Dates Prior to 1967): Colombia

Age Group	Reference Date	$_1q_0$	$_2q_0$
A. 1973 Census			
20-24	1971.7	.0698	.0850
25-29	1970.0	.0675	.0819
30-34	1967.9	.0698	.0850
35-39	1965.4	.0779	.0945
40-44	1962.9	.0831	.1014
45-49	1959.9	.0859	.1051
B. 1976 CFS - Individual			
20-24	1974.3	.0723	.0883
25-29	1972.5	.0665	.0805
30-34	1970.4	.0647	.0782
35-39	1968.1	.0750	.0919
40-44	1965.3	.0834	.1018
45-49	1962.4	.0887	.1089
C. 1976 CFS - Household			
20-24	1974.3	.0731	.0893
25-29	1972.5	.0676	.0821
30-34	1970.4	.0667	.0808
35-39	1968.0	.0755	.0926
40-44	1965.2	.0862	.1056
45-49	1962.2	.0876	.1074
D. 1978 NHS			
20-24	1976.4	.0661	.0800
25-29	1974.6	.0567	.0676
30-34	1972.5	.0626	.0754
35-39	1970.0	.0721	.0881
40-44	1967.1	.0879	.1078
45-49	1964.2	.0864	.1058

On the basis of these comparisons, the following conclusions can be drawn:

1. Estimates derived from the 1969 NFS are not reliable and tend to be too low.
2. The 1973 census seems to have suffered from generalized omission of children dead. Therefore, child mortality estimates derived from this source by using the best-fitting mortality model "North" are also too low. Some of these deficiencies are masked when the generally inappropriate "West" model is used. (Because of this masking, in the absence of any other information, Palloni's estimates are acceptable).
3. The CFS-Somoza estimates for 1962-70 are too low.
4. When derived from nonstandard age groups, the indirect child mortality estimates obtained from CFS data reveal strong age-related biases. Only the estimate associated with age group 28-32 seems acceptable.
5. Other indirect estimates derived from the CFS data classified according to the usual five-year age groups seem adequate. Those associated with ages ranging from 25-29 through 45-49 (referring to the 1962-72 period) are fairly similar to the ones associated with age groups 30-34 through 45-49 (referring to approximately the same period) of the 1978 NHS, although the latter tend to be slightly higher. However, it is possible that, especially at older ages, both sets of estimates may be affected by omission of dead children.
6. The 1978 NHS estimates associated with younger age groups (20-24 and 25-29) and referring to the period 1974-77 display an unacceptable trend. Errors in age reporting may be partly the cause, since the use of nonstandard age groups smoothes the estimates considerably. We believe the CFS-Somoza series for 1972-76 represents a reasonable, smooth approximation of the estimates available for this period.
7. In general, estimates derived directly from vital registration data tend to be higher than those obtained from other sources. For periods since 1972 it is clear that deficiencies in birth registration have led to overestimates of child mortality. During earlier periods, a similar type of problem may have been operating, but unfortunately the overlap between reliable indirect estimates and those derived from vital registration is too small to lead to any firm conclusions at this stage.



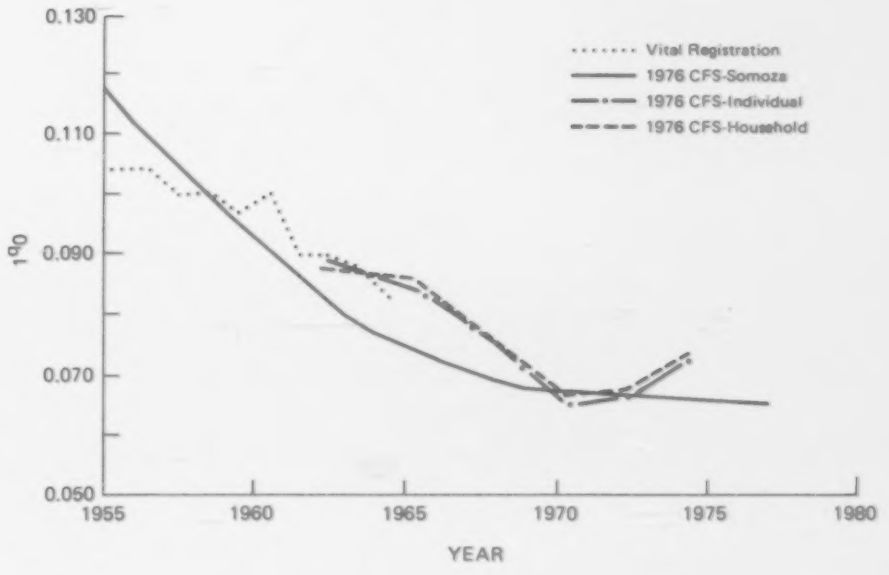


FIGURE 6 Comparison of Infant Mortality Estimates ($_1q_0$) Using Combination of North and North/West Models for Indirect Estimates: Colombia

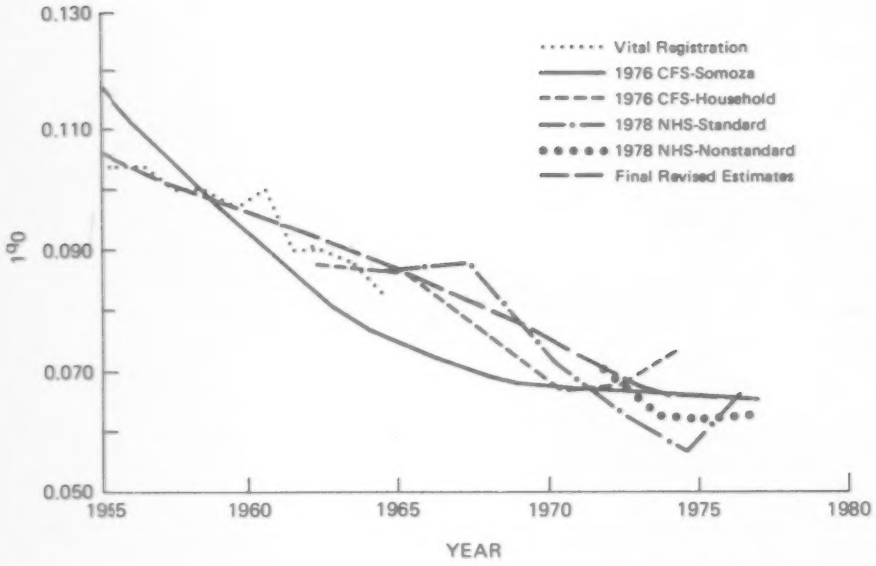


FIGURE 6 (continued)

2.2.5 A Revised Set of Child Mortality Estimates

Table 30 shows the set of key estimates of child mortality during the 1958-74 period selected on the basis of the conclusions reached above. For years prior to 1960, the best estimates are those obtained directly from the CFS fertility histories (see Table 27). Because these estimates refer specifically to the period 1956-60, its midpoint, 1958.5, was used as their reference date. For years since 1970, the direct CFS estimates were also judged to be adequate. Therefore, those corresponding to the period 1971-75 in Table 27 were adopted, and the refererce date 1973.5 was assigned to them.

For 1960-69, the best estimates appeared to be the indirect estimates derived either from the CFS household data or from the 1978 NHS (see Table 29). The estimates produced by these sources do not, however, coincide. Furthermore, at older ages of mother (45-49, and even 40-44 for the CFS), the estimates seem to be affected by selective omission of dead children. Since it is not possible to establish with certainty which of the remaining estimates for the 1960-69 period are the most reliable, it was decided to average them. Because each estimate refers to a different time point, those derived from the CFS were used to obtain, by linear interpola-

TABLE 30 Key Child Mortality Estimates, 1958-74: Colombia

Source[a]	Time Reference	Estimate $_1q_0$	Estimate $_2q_0$
CFS Individual	1958.5	.0993	.1273
CFS Household	1965.2	.0862	.1056
NHS Standard	1967.1	.0879	.1078
CFS Household	1968.0	.0755	.0926
CFS Individual	1973.5	.0662	.0837
Mean Estimate (from CFS Household and NHS Indirect Estimates)	1967.1	.0834	.1023
Interpolated Estimate	1963.5	.0901	.1128
Interpolated Estimate	1968.5	.0796	.0982

[a]See text for explanation of mean and interpolated estimates.

tion, one referring to the same time as that obtained from the NHS (1967.1). Then, the interpolated CFS value and the observed one from NHS were averaged. The result is shown in Table 30 as the "mean estimate" for 1967.1. Finally, linear interpolation was used to estimate $_1q_0$ and $_2q_0$ values for 1963.5 and 1968.5 on the basis of the mean estimate for 1967.1 and the CFS direct estimates for 1958.5 and 1973.5, respectively. The resulting quinquennial series of estimates (1958.5, 1963.5, 1968.5, and 1973.5) was used to derive a yearly series of child mortality estimates for the 1955-73 period. This was accomplished by interpolating linearly within the logit system having as standard the mortality experience of the 1968-76 cohort as recorded by the 1976 CFS (see Table 13). For 1974-78, the yearly estimates were taken from the CFS-Somoza series. This revised set of child mortality estimates is displayed in Table 31.

Panel 3 of Figure 6 shows plots of the revised $_1q_0$ estimates from Table 31. Relative to these revised estimates, the original 1976 CFS-Somoza series appears to slightly overestimate mortality for years prior to 1958 and underestimate it, at times substantially, for the

TABLE 31 Child Mortality Estimates for Both Sexes, 1955-78: Colombia

	$_xq_0$				
Year	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$
1955	.1062	.1384	.1497	.1743	.1885
1956	.1042	.1351	.1460	.1696	.1833
1957	.1022	.1320	.1424	.1650	.1781
1958	.1003	.1288	.1388	.1605	.1731
1959	.0984	.1258	.1353	.1561	.1681
1960	.0965	.1228	.1320	.1519	.1633
1961	.0946	.1199	.1286	.1477	.1586
1962	.0928	.1170	.1254	.1436	.1540
1963	.0910	.1142	.1222	.1396	.1495
1964	.0891	.1113	.1189	.1356	.1451
1965	.0868	.1082	.1156	.1316	.1407
1966	.0847	.1053	.1124	.1277	.1364
1967	.0826	.1024	.1092	.1239	.1323
1968	.0806	.0996	.1061	.1202	.1282
1969	.0782	.0967	.1030	.1167	.1246
1970	.0753	.0936	.0999	.1136	.1214
1971	.0726	.0907	.0969	.1105	.1183
1972	.0700	.0878	.0940	.1075	.1153
1973	.0674	.0851	.0912	.1046	.1123
1974	.0660	.0836	.0897	.1030	.1108
1975	.0657	.0833	.0894	.1029	.1106
1976	.0654	.0830	.0892	.1027	.1105
1977	.0650	.0827	.0889	.1025	.1104
1978	.0647	.0825	.0887	.1023	.1102

1958-73 period. The apparent overestimation of the CFS-Somoza series at earlier periods is due entirely to the interpolation procedure used in deriving it and to the fact that the CFS fertility histories underestimate mortality for the 1961-65 period. This underestimation is probably due to a combination of the truncation effect and true omissions of reported children dead. Notice that prior to 1958 the revised set of infant mortality estimates matches closely those derived from vital registration, suggesting that these new estimates may still be flawed.

In the sections that follow, the set of estimates in Table 31 are subjected to further scrutiny. To facilitate comparisons, estimates of child mortality by sex are needed. Mortality differentials by sex, estimated on the basis of the CFS fertility history data (Somoza, 1980:30) and assuming a sex ratio at birth of 1.05, are used to derive the sex-specific estimates presented in Table 32. Since these mortality differentials may not have held for the entire period under consideration, the series presented in Table 32 should be considered at most a plausible approximation of true trends.

To conclude, we note that even according to these preliminary estimates, infant mortality in Colombia declined by about 40 percent during the 1955-78 period. Somewhat greater declines are observed in other child mortality parameters during the same period; for example, in 1978, $_5q_0$ was down to 59 percent of its 1955 level. Although still far above the mortality rates of more developed countries, the estimated rates imply that Colombia's success in reducing child mortality has been far from negligible.

2.3 ADULT MORTALITY

The major sources of data relevant to estimating adult mortality are the censuses, the death registration system, and national household surveys such as the 1978 NHS.

There are two major types of techniques designed to estimate mortality on the basis of census counts and census age distributions. One type uses data from two censuses to trace the experience of cohorts during the intercensal periods, which is appropriate whenever the population under study can be assumed to be closed, that is, not subject to migration. The other type of technique makes use of the age distribution observed at one point in time and requires that the population under study be stable or quasi-stable, that is, subject to constant or near-constant fertility and mortality.

If a death registration system has been operational for a complete intercensal period, the first type of technique can be enhanced by incorporating registration data on the number of deaths occurring to each cohort. The resulting modified method provides estimates of relative census completeness of enumeration and relative completeness of death registration (Preston and Hill,

TABLE 32 Child Mortality Estimates by Sex, 1955-78: Colombia

	$_xq_0$										
Year	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$	Year	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$
Females						Males					
1955	.0974	.1336	.1445	.1683	.1821	1955	.1146	.1429	.1546	.1800	.1947
1956	.0956	.1305	.1409	.1638	.1770	1956	.1124	.1396	.1507	.1752	.1893
1957	.0938	.1274	.1375	.1594	.1720	1957	.1103	.1363	.1470	.1704	.1839
1958	.0920	.1244	.1340	.1550	.1671	1958	.1082	.1331	.1434	.1658	.1787
1959	.0902	.1215	.1307	.1508	.1624	1959	.1061	.1299	.1398	.1613	.1737
1960	.0885	.1186	.1274	.1466	.1577	1960	.1041	.1268	.1363	.1568	.1687
1961	.0868	.1157	.1242	.1426	.1532	1961	.1021	.1238	.1328	.1525	.1638
1962	.0851	.1130	.1211	.1386	.1487	1962	.1001	.1208	.1295	.1483	.1591
1963	.0835	.1103	.1180	.1348	.1444	1963	.0982	.1179	.1262	.1441	.1544
1964	.0816	.1074	.1149	.1309	.1401	1964	.0960	.1149	.1228	.1400	.1498
1965	.0796	.1045	.1116	.1270	.1359	1965	.0937	.1118	.1194	.1359	.1453
1966	.0777	.1017	.1085	.1233	.1318	1966	.0914	.1087	.1160	.1318	.1409
1967	.0758	.0989	.1054	.1196	.1278	1967	.0892	.1057	.1128	.1279	.1366
1968	.0739	.0962	.1025	.1160	.1238	1968	.0870	.1028	.1096	.1241	.1324
1969	.0717	.0933	.0995	.1127	.1203	1969	.0843	.0998	.1064	.1206	.1287
1970	.0691	.0904	.0965	.1097	.1173	1970	.0813	.0967	.1032	.1173	.1254
1971	.0666	.0876	.0936	.1067	.1143	1971	.0784	.0937	.1001	.1141	.1222
1972	.0642	.0848	.0908	.1038	.1113	1972	.0755	.0907	.0971	.1110	.1191
1973	.0619	.0821	.0881	.1010	.1085	1973	.0728	.0879	.0942	.1080	.1160
1974	.0606	.0807	.0866	.0995	.1070	1974	.0712	.0863	.0926	.1064	.1144
1975	.0603	.0804	.0864	.0993	.1068	1975	.0709	.0860	.0924	.1062	.1143
1976	.0600	.0802	.0861	.0991	.1067	1976	.0705	.0857	.0921	.1060	.1141
1977	.0597	.0799	.0859	.0990	.1066	1977	.0702	.0854	.0918	.1059	.1140
1978	.0594	.0796	.0856	.0988	.1064	1978	.0698	.0852	.0916	.1057	.1138

1980). The completeness of death registration can also be estimated from information on the number of deaths registered or reported during a given year, classified by age of the deceased (Brass, 1975; Preston et al., 1980).

Finally, estimates of mortality can be derived from information on the orphanhood status of a population or the widowhood status of the ever-married population. Data on these topics were gathered by the 1978 NHS. New versions of the methods first proposed by Brass and Hill (Hill et. al., 1982) are used in this report.

Since the levels of adult mortality in Colombia have already been estimated by several authors, most notably Lopez (1968) and Arriaga (1968), this section reviews their methods and results and evaluates them in light of recent methodological developments.

2.3.1 Existing Estimates

2.3.1.1 *Estimates by Lopez*

Lopez (1968) has provided the most thorough analysis of the development of the Colombian population from the point of view of stable and quasi-stable theory. His examination of the age distribution of the Colombian population as recorded by the 1938, 1951, and 1964 censuses led him to conclude that the population remained stable until approximately 1950. He attributed the observed rejuvenation of the population between 1951 and 1964 to the occurrence of a mortality decline that made the quasi-stable model appropriate for the population in 1964. The change in average annual intercensal growth rates, from 2.20 percent (.0220) during 1938-51 to 3.15 percent during 1951-64 according to raw figures, supported this conclusion. However, Lopez pointed out that the 1951 raw census count was known to be deficient and that several other estimates of the 1951 population had been proposed. These estimates ranged from a minimum of 11.9 million to a maximum of 12.3 million and implied quite different rates of change in the growth rate of the population between the two periods. By exploring the effects that the different pairs of intercensal growth rates (determined essentially by different estimates of the population in 1951) would have on the stable and quasi-stable estimates obtained by keeping the age distributions fixed (as observed), Lopez selected the most plausible combination among the set: a growth rate

of .024 for 1938-51 and of .029 for 1951-64. These growth rates are those implied by accepting that the total population in 1951 was 11,862,000 and that the male population between the ages of 20 and 50 in 1964 was underenumerated by 86,000. The final growth rate estimates for each sex are displayed in Table 33.

Using these growth rates, the observed age distributions of the population (slightly modified in the case of males in 1964), and stable or quasi-stable models where appropriate, Lopez derived estimates of the birth rate, death rate, expectation of life at birth, and expectation of life at age 5 according to the "South" and "West" mortality patterns from the Coale-Demeny regional model life tables (see glossary). Estimates of the birth rate, death rate, and e_0 are substantially affected by the choice of regional family. For example, the birth rate calculated using the "South" model is at least 7 percent greater than that derived from the "West" model. Estimates of e_5, on the other hand, are very similar in both models. Since the evidence presented on child mortality estimates suggests that "West" is an adequate model for the 1950-59 period, the estimates presented in Table 33 are those derived using the "West" model.

By comparing the average birth and death rates observed during the intercensal periods with their estimated values, Lopez produced estimates of the completeness of birth and death registration. These estimates, displayed in Table 34, were based not on the "West" estimates displayed in Table 33 but on an average of the "West" and "South" estimates published by Lopez. Therefore, if the

TABLE 33 Demographic Parameters for 1938-64, Estimated by Lopez Using the West Model: Colombia

	1938-51		1951-64	
	Male	Female	Male	Female
West Mortality Level	10.9	11.4	12.9	13.9
Birth Rate	.0457	.0425	.0470	.0443
Death Rate	.0214	.0186	.0175	.0142
Growth Rate	.0243	.0239	.0295	.0301
e_0 (years)	41.9	46.0	46.8	52.2
e_5 (years)	50.7	53.4	53.5	57.1

Source: Lopez (1968:64-65).

TABLE 34 Percentage Completeness of Birth and Death Registration, 1938-64, Estimated by Lopez Using Average Results from South and West Models: Colombia

	1938-51	1951-64
Deaths	68.3	67.2
Births	71.2	81.4

Source: Lopez (1968:68).

"West" pattern is indeed the closest representation of the Colombian experience prior to 1960, Lopez's estimates of completeness are probably somewhat low.

In using stable models to analyze the 1938 and 1951 data, Lopez's estimates reflect the assumption that the age distribution of the Colombian population was constant over that period. In fact, the 1938 and 1951 age distributions are similar but not identical, and to avoid favoring one over the other, Lopez based his estimates on an average of the two. Furthermore, in selecting the female stable population that best approximated the observed, Lopez used an average of the mortality levels implied by both the male and female age distributions. He followed this strategy because his estimated growth rates by sex (Table 33) implied that the estimated mean mortality level for males was higher than that for females. Lopez argued that this apparently higher level of mortality was the result of the male population under 50 being underreported while the female population in the same age range was overreported.

In estimating demographic parameters for the 1951-64 period, Lopez used the procedure described in Manual IV (United Nations, 1967). As indicated in the manual, the age distribution in 1964, coupled with the estimated growth rate for the 1951-64 intercensal period and with an estimate of its rate of change, can be used to estimate other demographic parameters. However, the procedure described in the manual does not make clear whether the estimated parameters refer to the intercensal period or to 1964. Coale (1971) and Mari Bhat (1977) have pointed

out that the estimation of parameters referring to 1964 is possible and that those derived as described in Manual IV do not strictly represent an intercensal average. Therefore, Lopez's estimates are not strictly correct from a methodological point of view, nor should they be used to estimate the average completeness of birth and death registration during 1951-64.

2.3.1.2 *Arriaga's Estimates*

Arriaga (1968) also estimated mortality using techniques based on stable population theory. However, his method of life table construction, although based on relationships that theoretically hold only in stable populations, is applied to cases in which only quasi-stability can be assumed. Arriaga's method uses the proportion of the population between ages 10 and 50, its age distribution, and model life tables to estimate a growth rate and a birth rate. These estimated values are then used to smooth the observed age distribution and to estimate the stable l(x) function. When mortality is assumed to be changing, the estimated growth and birth rates used must refer to exactly the year for which life table estimates are desired.

For Colombia, Arriaga obtained a preliminary growth rate estimate for 1951 from observed intercensal growth, assuming that the decline in the growth rate had been linear during the period. Then model life tables that produced values of the growth rate similar to the observed values were selected. The final growth rate estimates for males and females in 1951 were .0268 and .0276, respectively--higher than those of Lopez.

Table 35 shows the estimates of e_0 and e_5 obtained by Arriaga for 1938 and 1951. Their average, taken as roughly equivalent to an intercensal value, is compared to similar estimates obtained by Lopez. This comparison suggests that the sex differential in mortality implicit in Lopez's estimates is somewhat high.

2.3.2 Revised Stable and Quasi-Stable Estimates

Because of the questions raised above about both the Lopez and Arriaga estimates, it is necessary to reexamine the development of the Colombian population from 1938 to 1964 on the basis of stable and quasi-stable theory.

TABLE 35 Comparison of Estimated Expectations of Life: Colombia

	Arriaga			Lopez
	1938	1951	1938-51	1938-51
Males				
e_0	36.0	47.9	42.0	41.9
e_5	45.4	54.1	49.8	50.7
Females				
e_0	37.2	50.4	43.8	46.0
e_5	45.8	55.8	50.8	53.4

Source: Arriaga (1968).

According to the estimation procedures described in Manual IV (United Nations, 1967), a model stable population can be fitted to an observed population that has been subject to constant fertility and mortality during the past on the basis of its observed age distribution and its rate of natural increase. The latter is usually estimated from census counts which, unfortunately, do not often achieve the same degree of coverage at different points in time. As mentioned above, Lopez made a careful evaluation of the census counts since 1938, selecting a set whose implied growth rates were not inconsistent with other pieces of evidence. For reference, the set selected by Lopez and the raw census counts are shown in Part A of Table 36. The growth rates implied by different combinations of counts are shown in Part B of the table. Notice, however, that these growth rates are not exactly the same as those used by Lopez (see Table 33). For each sex, they are lower by 0.001. No reason could be found for this discrepancy. (Hereinafter, growth rates shown in Table 36 are referred to as "Lopez's estimates").

Table 37 shows the results obtained when the growth rates in Table 36 are used to fit a "West" model stable population to the average male and female age distributions observed during the 1938-51 period. Only the proportions under age x [C(x)] for x ranging from 10 to 40 were used, following Lopez's example. The results shown in Table 37 are very similar to those obtained by Lopez (Table 33).

TABLE 36 Raw and Adjusted Population Counts for 1938, 1951, and 1964, and Implied Growth Rates: Colombia

Census Date	Type of Count	Male Population	Female Population	Total Population	Sex Ratio (M/F)
Part A: Census Counts for 1938, 1951, and 1964					
1938.43	Raw	4,312,423	4,389,313	8,701,736	0.9825
1951.35	Raw	5,579,259	5,649,250	11,228,509	0.9876
	Lopez	5,894,031	5,967,969	11,862,000	0.9876
1964.54	Raw	8,614,652	8,869,856	17,484,508	0.9712
	Lopez	8,700,652	8,869,856	17,570,508	0.9809
Part B: Growth Rates Implied by Different Combinations of Census Counts					
1938-51	Raw-Raw	.0199	.0195	.0197	
	Raw-Lopez	.0242	.0238	.0240	
1951-64	Raw-Raw	.0329	.0342	.0336	
	Lopez-Lopez	.0295	.0300	.0298	

Two features of Table 37 are remarkable: first, the levels associated with the different C(x) values for males are relatively consistent, while those for females display a wider range of variation and a fairly consistent declining trend with age; second, the mean mortality level associated with male data is higher than that for females. Although this does not mean that estimated female mortality is higher than that of males (compare the estimated death rates for each sex), it does imply that the estimated male-female mortality differential in Colombia is smaller than that in the model life tables.

Apparently, it was this outcome that led Lopez to suggest that the male and female age distributions were affected by opposite biases, with too few males tending to be reported in the 15-39 age range and too many females appearing in the same age range because of age-reporting errors. However, although these types of biases are common, they do not entirely explain the observed difference in estimated mean levels. This is because the estimation method used is based on all the observed proportions under age x, for x ranging from 10 to 40, and even

TABLE 37 Fitting a Stable Population to the Colombian Population, 1938-51, Using Lopez's Growth Rates: Colombia

Part A: Age Distributions and Mortality Levels

Age x	Male C(x)	Male West Mortality Level	Female C(x)	Female West Mortality Level
10	.3075	11.72	.2959	12.66
15	.4322	11.07	.4135	12.60
20	.5299	12.13	.5209	11.81
25	.6248	11.43	.6169	10.79
30	.7003	11.59	.6973	10.17
35	.7616	12.13	.7574	10.69
40	.8210	11.46	.8172	9.85
Mean		11.65		11.22

Part B: Selected Parameters by Sex Corresponding to the Mean Mortality Level

	Male	Female
Birth Rate	.0441	.0426
Death Rate	.0199	.0188
Growth Rate	.0242	.0238

when the proportion in some age group (15-39, for example) is overstated, different C(x) values may be overstated or understated depending on the extent and pattern of other age-reporting errors. For example, notice that in the case of females, C(10) and C(15) are understated while C(30) and C(40) are probably overstated, but that it is difficult to decide whether C(20) is overstated or understated. Hence, opposite biases are likely to cancel each other when the mean is calculated, and a bias in one age range (15-39 in this case) need not necessarily lead to the equivalent bias on the mean level.

Although these observations cast doubts on Lopez's arguments, they do not explain why the apparent discrepancy in mortality levels arises nor do they reconcile

other inconsistencies in the estimates presented. For example, note that the estimated male and female birth rates are very similar. Since the sex ratio at birth is known to be fairly constant and its value, according to birth registration during the 1941-51 period, was 1.056 (Lopez, 1968), the observed sex ratio of the population should be 1.0201 if the estimated birth rates were correct. However, according to Table 36, the mean population sex ratio during 1938-51 amounted to only .9851. Although the difference between these two figures is not large in absolute terms, its implications in terms of mortality estimation are important. For example, notice that according to the observed sex ratio at birth and the mean sex ratio of the population just cited, the female birth rate consistent with the estimated male birth rate would be .0411; hence, given that the growth rate for females is .0238, the estimated death rate would be .0173, and these two values define a "West" female stable population with mortality level 12.08. In a similar way, to make the estimated female birth rate consistent with the one for males, one would have to assign to the male population a mortality level of 10.90. The large differences between these "consistent" mortality levels (10.90 and 12.08 for males and females, respectively) and those derived directly from the data in Table 37 (11.65 and 11.22) are disturbing.

The stable estimates suggested by Lopez are not the only ones leading to inconsistencies. Table 38 shows his quasi-stable estimates for 1951-64, obtained by assuming that the growth rate for each sex started to decline in mid-1949.[2] The most striking feature of this set of estimates is that the mortality differential between the sexes is in the opposite direction from that observed in the stable estimates for 1938-51: in 1964, estimated female mortality was approximately one level higher than that estimated for males. It must be pointed out that this reversal occurs even though the 1964 male population used during estimation had already been adjusted for the possible excess mortality (or excess undercount) caused by political strife during the 1960s (see the discussion of "violencia" in Lopez [1968]).

2.3.2.1 *Modifying Assumptions About Growth Rates*

Since Lopez's estimates appear to be unsatisfactory in several respects, we have attempted to reduce their

TABLE 38 Estimates of Quasi-Stable Parameters for 1951-64, Using Lopez's Growth Rates: Colombia

Part A. Age Distributions and Birth Rates

Age x	Male C(x)	Male Birth Rates Preliminary	Male Birth Rates Adjusted	Female C(x)	Female Birth Rates Preliminary	Female Birth Rates Adjusted
10	.3426	.05020	.04948	.3276	.04449	.04374
15	.4746	.05248	.05297	.4539	.04554	.04603
20	.5707	.04931	.05061	.5587	.04587	.04729
25	.6502	.04659	.04812	.6429	.04504	.04677
30	.7153	.04414	.04569	.7123	.04402	.04583
35	.7746	.04354	.04512	.7721	.04364	.04549
40	.8271	.04390	.04545	.8263	.04471	.04655

Part B. Selected Parameters by Sex

	Male	Female
1938-51 Growth Rate	.0242	.0238
1951-64 Growth Rate	.0295	.0300
t_o	1949.50	1949.50
t_m	1957.95	1957.95
Δ_t	8.45	8.45
Δ_r	.000627	.000734
k	.01116	.01306
1964 Birth Rate	.0482	.0460
1964 Death Rate	.0146	.0112
1964 Growth Rate	.0336	.0348
1964 North Mortality Level	14.98	16.06

deficiencies by adopting alternative assumptions. For the 1938-51 period, one questionable aspect of Lopez's data is that different growth rates apply to males and to females. If the population had truly been stable prior to 1951, growth rates differing by sex would be unlikely. Therefore, it seems more reasonable to assume that the growth rates during 1938-51 should be the same for both sexes. Finding the most plausible value for these rates, however, is not possible without making further assumptions. To limit the number of choices, it was assumed that either the male growth rates or the female growth rates estimated by Lopez were correct. Hence, two new sets of stable and quasi-stable estimates were calculated: one assuming that the growth rate of females for 1938-51 applied to males (Set 1), and the other assuming

that the growth rates of males for the same period applied to females (Set 2).

Tables 39 and 40 show the results obtained under the Set 1 assumption. The first result of interest is that the mean mortality level for males during 1938-51 (Table 39) is 11.25, a value very close to the one estimated for females (11.22) using the same growth rate of .0238 (see Table 37). Adopting the male birth rate in Table 39 increases the sex differential in birth rates over that shown in Table 37, but not enough to account for the relatively low overall sex ratio of .9851 of the

TABLE 39 Stable Estimates for Males Using the Growth Rate of Females, 1938-51 (Set 1): Colombia

Part A. Age Distributions and Mortality Level

	Male	
Age x	C(x)	West Mortality Level
10	.3075	11.29
15	.4322	10.66
20	.5299	11.71
25	.6248	11.03
30	.7003	11.21
35	.7616	11.76
40	.8210	11.12
Mean		11.25

Part B. Selected Parameters Corresponding to the Mean Mortality Level

Birth Rate	.0445
Death Rate	.0207
Growth Rate	.0238

TABLE 40 Quasi-Stable Estimates for Males Using the Growth Rate of Females, 1951-64 (Set 1): Colombia

Part A. Age Distributions and Birth Rates

	Male		
		Birth Rates	
Age x	C(x)	Preliminary	Adjusted
10	.3426	.04963	.04880
15	.4746	.05184	.05240
20	.5707	.04864	.05014
25	.6502	.04601	.04778
30	.7153	.04370	.04550
35	.7746	.04313	.04496
40	.8271	.04354	.04533

Part B. Selected Parameters

1938-51 Growth Rate	.0238
1951-64 Growth Rate	.0300
t_o	1949.50
t_m	1957.95
Δt	8.45
Δr	.000734
k	.01306
1964 Birth Rate	.0478
1964 Death Rate	.0130
1964 Growth Rate	.0348
1964 North Mortality Level	15.94

population. (Birth rates of .0445 for males and .0426 for females imply an overall population sex ratio of 1.0109 when the sex ratio at birth is 1.056.) In addition, the revised quasi-stable mortality estimates for males for 1964 (Table 40) are fairly consistent with those estimated for females; for example, compare the 1964 male mortality level of 15.94 (in Table 40) with the estimated female level of 16.06 (shown in Table 38). Once more, however, the birth rate differential by sex is inconsistent with the sex ratio of the population in 1964, even though the sex ratio at birth had declined to 1.034 for the 1953-69 period.

Tables 41 and 42 show the results of using the male growth rates to estimate stable and quasi-stable parameters for females (the Set 2 assumption). In addition, Table 42 shows the quasi-stable estimates for males using the male growth rates estimated by Lopez, but assuming that mortality started to decline in mid-1950 rather than in mid-1949 (see footnote 2). The estimates for females in Table 42 are also based on this assumption. Note the consistency between the estimated 1938-51 mean mortality level for females (Table 41) and that for males (Table 37). The birth rate differential implied by these estimates is still insufficient to account for the low population sex ratio observed, but it is slightly more favorable than that implied by the estimates obtained when the female growth rate is used (Set 1 assumption). The quasi-stable estimates (Table 42) also yield similar mortality levels for both sexes in 1964, although again the birth rate differential by sex is inconsistent with the observed population sex ratio.

Notice that in Table 42 the 1951-64 growth rates used for the two sexes are not identical. The reason is that once the same male growth rate was applied to both sexes during the 1938-51 period, the census counts had to be modified to make them consistent with the selected rates. The modification of the counts was somewhat arbitrary, but two guidelines were followed in the process:

(a) The overall population sex ratios (shown in Table 36) seem rather low. Hence, a modification that increased them was preferred over one that reduced them.
(b) Undercounts are more likely than overcounts. Hence, it was preferable to increase a count rather than to reduce it.

TABLE 41 Stable Estimates for Females Using the Growth Rate of Males, 1938-51 (Set 2): Colombia

Part A. Age Distributions and Mortality Level

Age x	Female C(x)	Female West Mortality Level
10	.2959	13.33
15	.4135	13.07
20	.5209	12.25
25	.6169	11.18
30	.6973	10.54
35	.7574	11.06
40	.8172	10.19
Mean		11.66

Part B. Selected Parameters Corresponding to the Mean Mortality Level

Birth Rate	.0422
Death Rate	.0180
Growth Rate	.0242

Following these guidelines only one count needs to be modified in each instance to obtain sets consistent with the assumed growth rates. For Set 1, where the growth rate is .0238 for both males and females, the male count for 1938 was modified to 4,334,917. For Set 2, with a growth rate of .0242, the female count for 1951 was modified to 5,998,913.

TABLE 42 Quasi-Stable Estimates for Both Sexes Obtained by Using the Male Growth Rates Estimated by Lopez, 1951-64 (Set 2): Colombia

Part A. Birth Rates by Sex

Age x	Male Birth Rates		Female Birth Rates	
	Preliminary	Adjusted	Preliminary	Adjusted
10	.05020	.04947	.04484	.04418
15	.05248	.05287	.04599	.04634
20	.04931	.05045	.04633	.04742
25	.04659	.04793	.04545	.04678
30	.04414	.04549	.04441	.04579
35	.04354	.04493	.04398	.04541
40	.04390	.04524	.04507	.04647

Part B. Selected Parameters by Sex

	Male	Female
1938-51 Growth Rate	.0242	.0242
1951-64 Growth Rate	.0295	.0296
t_o	1950.50	1950.50
t_m	1957.95	1957.95
Δt	7.45	7.45
Δr	.000711	.000725
k	.01266	.01291
1964 Birth Rate	.0476	.0462
1964 Death Rate	.0134	.0118
1964 Growth Rate	.0342	.0344
1964 North Mortality Level	15.72	15.62

2.3.2.2 *Assessing the Modified Adult Mortality Estimates by Reference to Corresponding Child Mortality Estimates*

Evidence presented earlier in this chapter suggests that the "West" model represented Colombian child mortality during 1938-51 quite closely, while the observed pattern was closer to the "North" model around 1964. Since the stable and quasi-stable estimates for these two time periods have been presented in terms of the "West" and "North" models, respectively, it is possible to derive from them a series of child mortality estimates comparable to those presented in Table 32. This derivation was carried out by means of the logit system (see glossary) with female level 16 of the "West" model as standard.

The alpha and beta parameters relating this standard to the stable and quasi-stable estimates presented above were interpolated linearly to generate a series of yearly child mortality estimates. Two combinations of stable and quasi-stable estimates (with growth rates shown in Table 43) were used, reflecting the two growth-rate assumptions made above (Sets 1 and 2). Figure 7 compares the ${}_1q_0$ estimates for males and females. Figure 8 shows the estimated ${}_2q_0$, ${}_3q_0$, and ${}_5q_0$ values.

Figure 7 reveals fairly good correspondence around 1960-62 between the stable estimates (Sets 1 and 2) and those presented in Table 32. However, before that point the estimates of Table 32 are lower than the stable estimates, while for later years the reverse is true. In both cases, the "low" estimates approximate those obtained directly from vital registration, which makes their accuracy doubtful.

According to both Figures 7 and 8, the estimates in Table 32 for the years prior to 1960 seem too low. However, for 1961-65 the general consistency of estimates obtained from very different sources and using completely different methods is reassuring. Furthermore, notice that circa 1964, the consistency increases as the x of ${}_xq_0$ increases. This tendency is indicative of the fact that the "North" model does not fit perfectly the Colombian experience, although it probably provides the best possible fit among the models available. Also worth noting is that the sex differential implicit in the stable estimates is greater than that estimated on the basis of CFS data (as in Table 32). However, the differ-

TABLE 43 Summary of Growth Rates Used in Deriving the Revised Sets of Stable and Quasi-Stable Estimates: Colombia

	Growth Rate	
Assumption	1938-51	1951-64
Set 1	.0238	.0300
Set 2	.0242	.0295 (males) .0296 (females)

ential is smaller than that implied by the preliminary stable and quasi-stable estimates (Tables 37 and 38). In other words, consistency between the estimates derived from different sources has been greatly enhanced by using the same growth rate for both sexes in 1938-51.

2.3.2.3 *Selecting Optimal Estimates for Each Time Period*

Although one cannot be certain which set of estimates above is closer to the truth, the following observations have been used as a guide in selecting the most satisfactory set:

1. As stated earlier, the Table 32 estimates for years prior to 1959 are fairly weak, since they were derived mainly by extrapolation. Furthermore, those corresponding to the 1958-59 period were obtained from the CFS fertility history data (the only source yielding estimates for such period, if vital registration is disregarded). Given the biases that often affect such information and the close coincidence of CFS estimates of infant mortality with those obtained from vital registration, it seems possible that both may be too low.
2. Sets 1 and 2 yield very similar sets of estimates for males. Around 1964, Set 1 seems somewhat better behaved in terms of ${}_2q_0$, ${}_3q_0$, and ${}_5q_0$ (Figure 8), but Set 2 is acceptable and, if anything, implies a slight downward bias in some of the 1964-65 child mortality estimates of Table 32.
3. Sets 1 and 2 differ more markedly for females than for males, and Set 1 implies consistently that female mortality is overestimated in 1964-65 by Table 32. Since overestimation is less likely than underestimation, Set 2 seems preferable.

It would seem therefore that the Set 2 estimates could be adopted for years prior to 1960; that for 1960-66 some smoothed average of the estimates of Set 2 and Table 32 would be acceptable; and that for 1967 and later, the estimates in Table 32 could be adopted.

2.3.3 Intercensal Estimates

Colombia's vital registration system published an uninterrupted series of registered deaths for the period 1951-64. It therefore presents an ideal opportunity for applying the Preston and Hill (1980) method of estimating

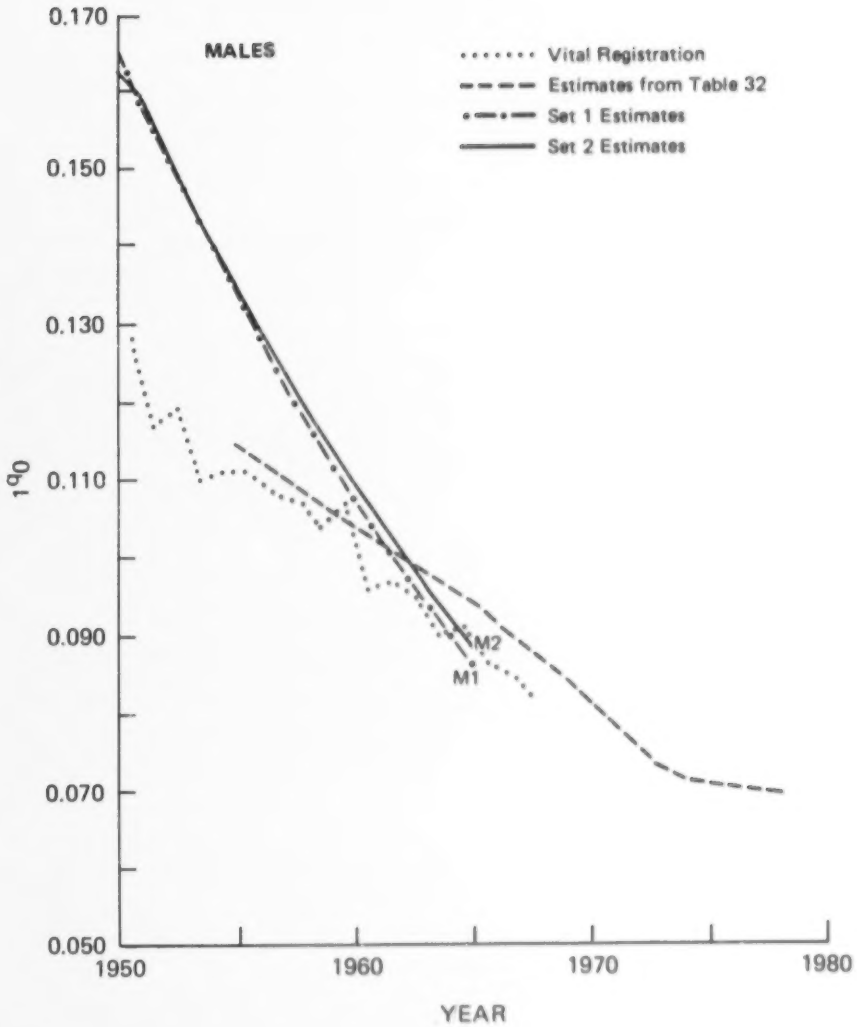


FIGURE 7 Comparison of Infant Mortality Estimates ($_1q_0$), 1950-78: Colombia

the completeness of death registration and the completeness of enumeration of the second census, both relative to the completeness of the first.

This method is based on the following equation:

$$\frac{P_1(x)}{C_1} = \frac{P_2(x+t)}{C_2} + \frac{D(x)}{k} \qquad (1)$$

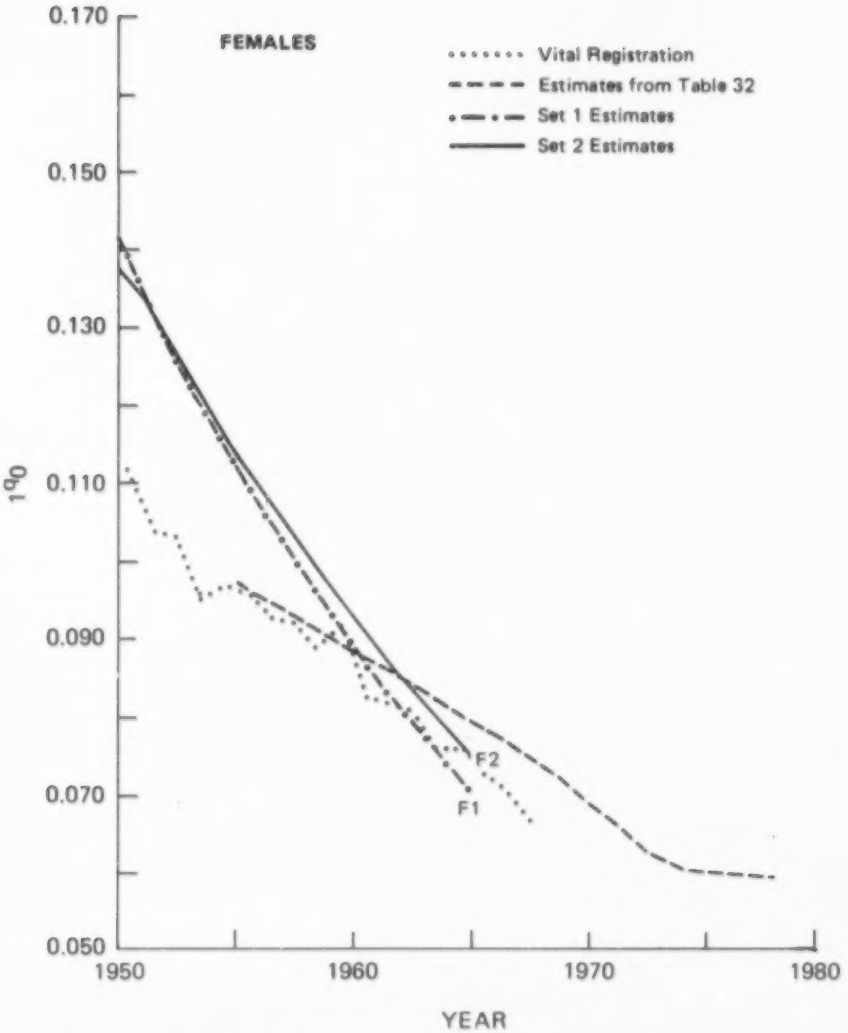
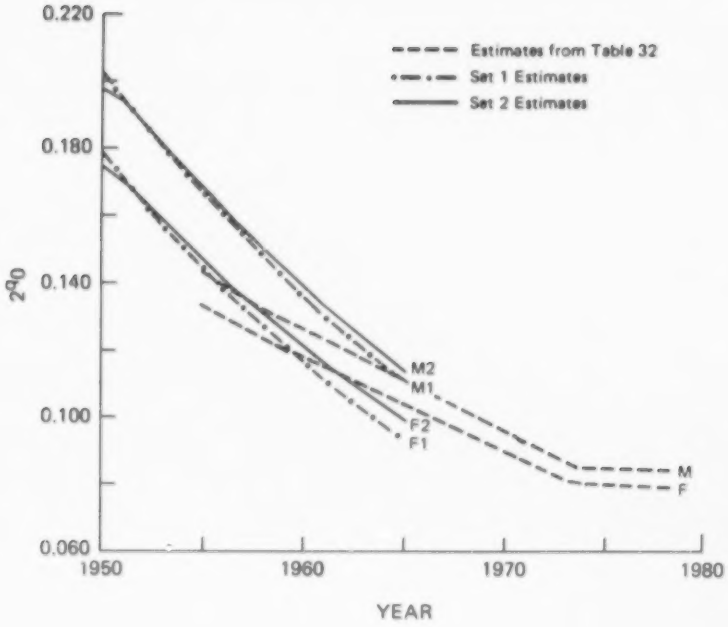


FIGURE 7 (continued)

where t is the length of the intercensal period; $P_1(x)$ is the population aged x at the first census; $P_2(x+t)$ is the population aged x+t at the second census; D(x) are the deaths that occurred during the intercensal period to the cohort aged x at the first census; C_1 and C_2 are the completeness of enumeration of the first and second censuses, respectively; and k is the completeness of death registration. Equation (1) holds true in populations where there is no migration (i.e., the population



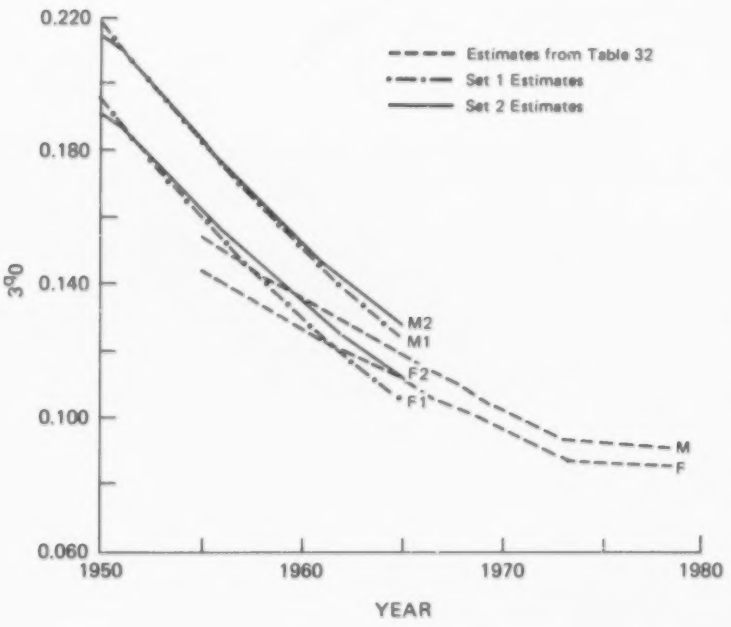


FIGURE 8 Comparison of Child Mortality Estimates ($_2q_0$, $_3q_0$, and $_5q_0$), 1950-78: Colombia

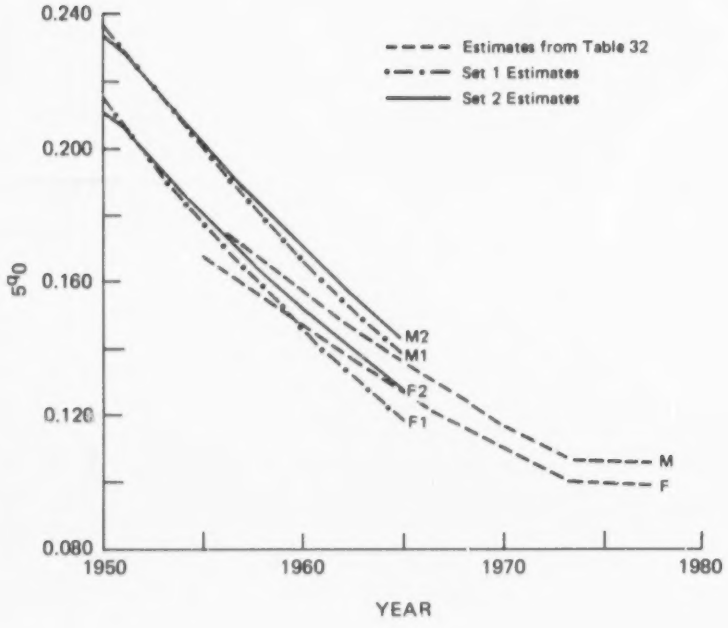


FIGURE 8 (continued)

is closed) and where the completeness of coverage of both censuses and vital registration is independent of age. In the case of Colombia, migration during the 1951-64 intercensal period was very low (Lopez, 1968), so, at least for exploratory purposes, the population may be considered closed. The second assumption can be treated in a similar way, because although it is likely that underenumeration of young children may be greater than that at other ages, younger ages have relatively little weight in the application of the method.

Equation (1) can be rewritten thus:

$$\frac{P_1(x)}{P_2(x+t)} = \frac{C_1}{C_2} + \frac{C_1}{k}\left(\frac{D(x)}{P_2(x+t)}\right) \qquad (2)$$

Hence, a line fitted to the points $[(P_1(x)/P_2(x+t), D(x)/P_2(x+t)]$ would have as its slope the value of C_1/k and as its intercept the value of C_1/C_2. If one assumes then that $C_1 = 1$, that is, that the first census is complete relative to itself, then the slope of

this line is a correction factor for deaths while the y-intercept is a correction factor for the second census. The reciprocals k/C_1 and C_2/C_1 are, respectively, the completeness estimates of death registration and of enumeration at the second census with respect to the completeness of the first.

Equations (1) and (2) are also valid if, instead of using cohorts of a given age, one uses open-ended cohorts, that is, the population aged x and over at the first census $[P_1(x+)]$, the population aged (x+t) and over at the second census $[P_2((x+t)+)]$, and the intercensal deaths to this cohort, denoted by D(x+). In populations where age-reporting errors are frequent, this cumulated version of equation (2) is preferable, since it reduces the effects that such errors may have on the completeness estimates.

Table 44 shows the results of applying the cumulated version of the Preston-Hill method to the 1951-64 Colombian data by sex. Part A shows an index of enumeration by cohort, U(x+), where

$$U(x+) = \frac{P_2[(x+t)+] + D(x+)}{P_1(x+)} \qquad (3)$$

If death registration and census enumeration were complete, and both were free of age-reporting errors, U(x+) should be identical to one in a closed population. Deviations from one occur because of incompleteness in one of the sources or because of age-reporting errors, whose effects are reduced but not entirely eliminated by using the cumulated version of equation (2).

Since the data used to generate Table 44 refer to cohorts aged x and over in 1951, only net transfers across their lower age boundary affect the final results. That these transfers exist is shown by the very high values of U observed at older ages among males. From age 55 on, U is consistently greater than one and increasing. This behavior implies that either the deaths or the population enumerated at the second census have been consistently shifted to older ages or that the population in 1951 was shifted to younger ages. Detailed examination of the raw data reveals no evidence of a net downward shift of the population over age 55 in 1951. In fact, when the 1951 age distribution is compared with any of the fitted stable models presented in the last section, it becomes clear that the male population over 55 in 1951 was, if anything, slightly exaggerated. Hence, one must

TABLE 44 Estimates of the Completeness of Enumeration and of Death Registration Using the Preston-Hill Intercensal Estimation Method, 1951-64: Colombia

Part A. Index of Enumeration U(x+)

Age x	Male	Female
0	0.9836	1.0220
5	0.9714	0.9969
10	0.9750	0.9806
15	0.9866	0.9653
20	0.9855	0.9636
25	0.9944	0.9663
30	0.9807	0.9583
35	0.9811	0.9507
40	0.9817	0.9572
45	0.9942	0.9727
50	0.9861	0.9503
55	1.0232	0.9698
60	1.0028	0.8896
65	1.1215	0.9689
70	1.1413	0.8347
75	1.3932	0.8641
80	1.5678	0.7350

Part B. Estimates of Completeness of Enumeration and of Death Registration

	Male			Female		
		Estimates of Completeness			Estimates of Completeness	
Range of Points Used	Correlation Between Points	Deaths	Second Census	Correlation Between Points	Deaths	Second Census
0-35	.9954	1.01	0.98	.9889	0.75	1.03
0-40	.9979	0.99	0.98	.9906	0.81	1.01
0-45	.9987	1.01	0.98	.9898	0.88	1.00
0-50	.9994	1.00	0.98	.9949	0.89	0.99
0-55	.9988	1.05	0.97	.9963	0.93	0.98
0-60	.9994	1.03	0.97	.9956	0.85	1.01
0-65	.9951	1.14	0.94	.9948	0.91	0.99
Mean		1.03	0.97		0.86	1.00

conclude that either age at death or the age of the population in 1964 has been exaggerated. In the case of males, both processes appear to be operating.

In the case of females, the picture is not so obviously inconsistent. Only one value of U, that for the first age group, is greater than one. The most likely causes of this discrepancy are the relatively greater under-enumeration of young female children in 1951 or a net upward transfer of females through the 13-year boundary in 1964. Both processes may have been operating, but their net effect (a 2-percent excess) is small.

As expected, the points defined by the $D(x+)/P_2[(x+t)+]$ and $P_1(x+)/P_2[(x+t)+]$ ratios display fairly linear trends. The only exceptions are, possibly, the last two or three points of each set (corresponding to ages 70 and over), so they were not used in fitting a straight line. Part B of Table 44 shows the completeness estimates obtained by fitting straight lines to several sets of points using the least-squares method. In general, the correlations between the points used in each case are fairly close to one, implying that the linear relationship is strong. However, for a given sex, the completeness estimates associated with different lines are not all identical. Thus, selection of the line that is most likely to represent reality must be based on independent evidence about the quality of the data at hand.

In this respect, it is important to note that the data used in deriving the estimates presented in Table 44 include the raw census counts and age distributions. It has already been noted that the male age distribution produced by the 1964 census is very likely to be deficient because of selective underenumeration of adult males. Since the Preston-Hill method assumes that underenumeration is constant over the whole age range, a bias of this type may seriously affect the completeness estimates that the method yields. To ascertain the magnitude of these effects, completeness estimates were derived using an adjusted 1964 male age distribution. The results are shown in Table 45.

2.3.3.1 *Comparing Adjusted and Unadjusted Intercensal Estimates*

Comparison of the three sets of completeness estimates for 1951-64 (males and females in Table 44 and "adjusted" males in Table 45) leads to three main observations. First, within each set the variability of the census completeness estimates (C_2/C_1) is usually less than that of the estimates of completeness of death registration. This apparent robustness of the C_2/C_1 estimates has led investigators to assert that the Preston-Hill method usually yields better estimates of relative census coverage than of death registration completeness. This assertion, although basically valid, should not be interpreted too strictly because, although the absolute bias in C_2/C_1 may be smaller than that affecting k/C_1,

TABLE 45 Estimates of the Completeness of Enumeration and of Death Registration for Males Using the Preston-Hill Intercensal Estimation Method, 1951-64, with an Adjusted 1964 Age Distribution: Colombia

Part A. Index of Enumeration U(x+)

Age x	Male
0	1.0195
5	1.0145
10	1.0145
15	1.0221
20	1.0155
25	1.0169
30	0.9928
35	0.9811
40	0.9818
45	0.9942
50	0.9861
55	1.0232
60	1.0028
65	1.1216
70	1.1413
75	1.3932
80	1.5678

Part B. Estimates of Completeness of Enumeration and of Death Registration

Range of Points Used	Correlation Between Points	Estimates of Completeness: Deaths	Estimates of Completeness: Second Census
0-35	.9964	0.85	1.05
0-40	.9982	0.87	1.05
0-45	.9977	0.91	1.03
0-50	.9987	0.93	1.03
0-55	.9973	1.00	1.01
0-60	.9988	1.00	1.01
0-65	.9939	1.12	0.97
Mean		0.95	1.02

its implications in terms of growth rate estimates may be significant.

The second observation concerns the behavior of the k/C_1 estimates (the completeness of death registration relative to the completeness of the first census). Notice that in all three sets of estimates the completeness of death registration tends to increase as the number of points used in fitting the line increases. This outcome is probably a consequence of the tendency to exaggerate age at death. It is interesting to note that the tendency seems to affect both males and females, even though the enumeration indices U(x+) for females (see Table 44) do not show any marked inconsistency.

Thirdly, the means of the census completeness estimates in Table 44 imply that the 1951 and 1964 census counts achieved very similar levels of coverage for males and females (0.97 and 1.00, respectively), despite the relative undercount of males in 1964. In contrast, when the 1964 male population is adjusted (Table 45), the 1964 population appears to be overcomplete by about 2 percent relative to the 1951 count.

2.3.3.2 *Comparing Intercensal Estimates to Stable and Quasi-Stable Estimates*

To make valid comparisons, the stable and quasi-stable estimates presented in the previous section were used to generate a starting stable age distribution, which was then projected to 1951 and 1964 by means of mortality schedules consistent with the estimated stable and quasi-stable parameters. These estimated age distributions, in conjunction with estimated population counts consistent with the stable and quasi-stable growth and birth rates of Tables 39 through 42 (see Table E.1 in Appendix E), were used to generate completeness estimates directly comparable with those that the Preston-Hill method should yield in theory. These estimates are presented in Table 46.

A comparison of the estimates presented in Table 46 with those of Tables 44 and 45 leads to the following conclusions:

1. The Preston-Hill completeness estimates for intercensal male deaths based on the observed data (Table 44) are too high, mainly due to the relative underenumeration of the 1964 adult male population and exaggeration of age at death.

TABLE 46 Preston-Hill Equivalent Estimates Obtained by Using Stable and Quasi-Stable Parameters, 1951-64: Colombia

Estimates and Reference Population	Estimates of Completeness: Death Registration $\frac{k}{C_1}$	Estimates of Completeness: 1964 Census Relative to 1951 Census $\frac{C_2}{C_1}$
Set 1		
Males - Observed	0.803	1.009
Males - 1964 Adjusted	0.803	1.050
Females - Observed	0.754	1.054
Set 2		
Males - Observed	0.801	1.012
Males - 1964 Adjusted	0.801	1.053
Females - Observed	0.743	1.061

2. Most of the completeness of death registration estimates produced by the Preston-Hill method are subject to an upward bias brought about by the exaggeration of age at death. Only when the set of points used is truncated at fairly young ages (35 or so) are the estimates somewhat similar to those implied by the stable and quasi-stable parameters (Table 46), ignoring estimates obtained from the unadjusted data for males (Table 44).
3. Biases in the estimates of relative census coverage are certainly smaller than those in the estimates of death registration completeness, but they exist nevertheless. In the case of females, for example, the mean value of C_2/C_1 according to the Preston-Hill method is 1.00, while it would be near 1.06 according to the stable and quasi-stable estimates. Although the latter is not necessarily correct, the Preston-Hill results are more likely to be affected by age-reporting errors. The fact that the best consistency between the two sets of estimates is attained by considering only the first few

points in applying the Preston-Hill method (0-35) lends support to this conclusion.

4. In general, once the estimates for males using unadjusted data are discarded, the Preston-Hill estimates associated with points 0 to 35 are acceptably close to those implied by the stable and quasi-stable fits.

Table 47 presents a comparison of the observed age distributions of the population and of intercensal deaths with the ones implied by a projection based on the stable and quasi-stable parameters associated with Set 2. (The Set 1 parameters yield very similar results that are not presented here.) The most important fact revealed by these comparisons is that age tends to be exaggerated in all the age distributions considered. This is especially so for age at death, where deviations of the observed from the estimated age distributions are mainly positive and increase with age. For the age distribution of the population, high levels of age exaggeration are concentrated mostly at relatively advanced ages (60 and over) and the magnitude is fairly similar for males and females. In contrast, female deaths exhibit much lower levels of

TABLE 47 Comparison of the Age Distributions Used in Applying the Preston-Hill Method and Those Derived from Stable and Quasi-Stable Estimates, 1951-64 (Set 2): Colombia

	1951		Intercensal Deaths			1964		
	$100(C_0(x+)/C_e(x+)-1)$		$100(D_0(x+)/D_e(x+)-1)$			$100(C_0(x+)/C_e(x+)-1)$		
Age x	Male	Female	Male	Female	Age y	Male		Female
						Raw	Adjusted	
5	-0.20	0.36	0.73	-2.12	18	-1.53	-0.63	-1.88
10	-0.72	0.52	1.79	-0.84	23	-1.46	-0.90	-3.09
15	-1.20	1.02	3.37	0.99	28	-0.47	-0.32	-3.93
20	0.00	0.35	4.97	2.83	33	1.03	0.64	-4.51
25	-1.52	-1.90	6.72	4.21	38	0.46	-0.75	-6.31
30	-0.88	-3.51	9.11	5.35	43	-0.49	-2.85	-8.65
35	0.36	-2.59	11.24	5.79	48	1.33	-2.64	-7.70
40	-0.75	-5.83	13.26	5.73	53	-0.01	-3.93	-9.82
45	-0.09	-5.38	15.68	5.95	58	2.87	-1.16	-5.50
50	2.83	-4.00	18.36	6.74	63	6.51	2.33	-4.65
55	0.46	-4.97	21.10	7.09	68	9.53	5.23	0.77
60	9.86	5.37	28.72	8.80	73	23.79	18.94	9.85
65	10.72	4.96	41.23	10.29	78	62.94	56.55	50.66
70	29.22	25.04	68.87	12.68	83	131.97	122.87	108.67
75	54.39	42.93	146.01	28.53	88	432.43	411.55	384.24
80	140.07	124.46	335.95	77.32	93	--	--	--

$C_0(x+)$: Observed proportion of the population aged x and over.
$C_e(x+)$: Estimated proportion of the population aged x and over.
$D_0(x+)$: Observed deaths to the cohort aged x and over in 1951.
$D_e(x+)$: Estimated deaths to the cohort aged x and over in 1951.

exaggeration than those of males. This observation is consistent with the evidence yielded by the enumeration indices U(x+) of Table 44.

2.3.4 Estimates of Death Registration Completeness Based on the Age Distribution of Deaths

Further indications of exaggeration of age at death in the 1951 data were obtained using an estimation method recently developed by Preston and Coale (United Nations, 1982). This method is essentially based on the same set of assumptions underlying the Brass (1975) growth balance equation method (stability being the main one), but it also requires as input an estimate of the growth rate. In the case of Colombia, this requirement presents no problems because the available growth rate estimates all fall within a fairly narrow range and are not expected to seriously distort the estimates yielded by the method.

Figure 9 shows the age-specific estimates of completeness of death registration obtained for 1951 using a growth rate of 0.0238 for both males and females. (Each estimate represents the completeness of registered deaths over age x.) The semi-cumulated version of the Preston-Coale method was used in deriving these estimates, the population being truncated at age 80. (Therefore, semi-cumulation implies that only the population aged x to 79 is considered). The most important feature of the graphs presented is that the completeness estimates increase with age. Such an increase might be attributed to any of several causes: a consistently greater incompleteness of the population as age increases; an increasing completeness of death registration as age increases (or, equivalently, the exaggeration of age at death); or, a faulty estimate of the growth rate. Of these three causes, the first seems unlikely on the basis of the comparisons of observed and estimated age distributions shown in Table 47. The third can be rejected because, especially in the case of males, the curves in Figure 9 deviate substantially from the almost linearly increasing trend that would be expected if the growth rate were underestimated. Thus, the second alternative, exaggeration of age at death, seems the most plausible explanation.

Preston et al. (1980) have pointed out that when exaggeration of age at death is prevalent, the completeness curve typically displays a plateau at younger ages and increases only after the age at which exaggeration

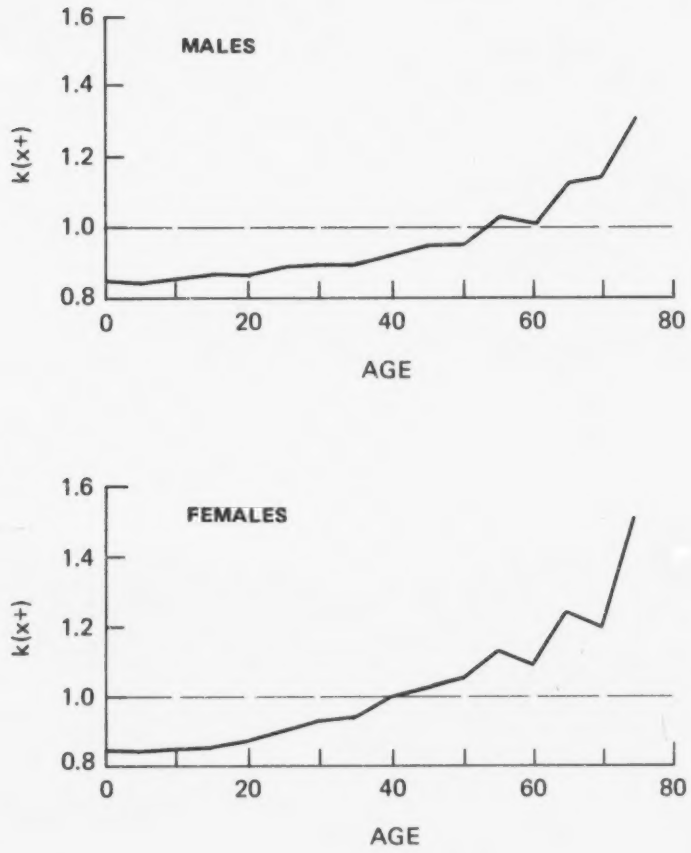


FIGURE 9 Estimated Completeness of Death Registration by Age, Using the Preston-Coale Method Truncated at Age 80, with Growth Rate 0.0238, 1951: Colombia

becomes substantial. In the case of Colombia, this description fits well the 1951 curves for both males and females. For females the plateau is somewhat less flat, but it exists nonetheless, and the female curve certainly does not approximate a linear trend.

A final piece of evidence that supports the existence of some distortion in the age distribution of deaths at older ages is provided by comparing the mean completeness estimates obtained by truncating the population at ever decreasing ages. The nature of the Preston-Coale method is such that if the population is truncated at age x (that is, only the population under age x is considered), the age distribution of deaths over age x has no influence

on the completeness estimates obtained. That is, truncation minimizes the biases introduced by the possible age exaggeration of deaths. Therefore, in a population where such exaggeration exists, one expects the mean completeness estimates to increase as the truncation age increases. As Table 48 illustrates, this is exactly what happens in the case of the 1951 Colombian data.

Similar tests of consistency can be applied to the 1964 data, although the picture for 1964 is somewhat less precise because of the quasi-stable character of the population. However, as Figure 10 and Table 49 show, the same characteristics detected in 1951 are present in the 1964 data. Therefore, one must conclude that significant exaggeration of age at death exists at both points in time.

Since the data at hand do not satisfy the assumptions on which the Preston-Coale method operates, the estimates it would produce would be biased. Fortunately, even when the estimates of completeness increase with age, those forming the initial plateau are subject to less bias than the rest. Therefore, it is possible to use the estimates

TABLE 48 Estimated Mean Completeness of Death Registration for Different Truncation Points of the Population, 1951: Colombia

	Estimated Mean Completeness Over Age 5	
Truncation Age	Male	Female
45	0.808	0.781
50	0.831	0.806
55	0.810	0.808
60	0.860	0.883
65	0.845	0.864
70	0.890	0.932
75	0.910	0.942
80	0.966	1.028
85	0.983	1.033

Note: Growth rate = 0.0238.

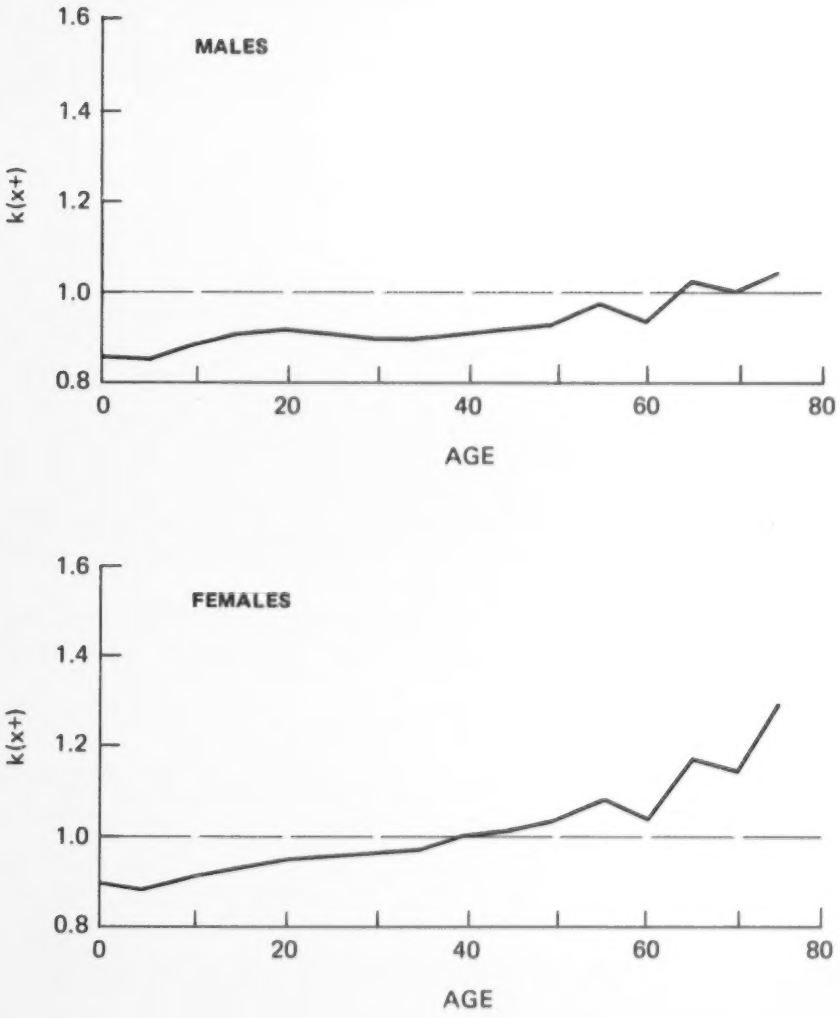


FIGURE 10 Estimated Completeness of Death Registration by Age, Using the Preston-Coale Method Truncated at Age 80, with Growth Rates 0.0295 and 0.0296, 1964: Colombia

constituting the plateau as guidelines for redistributing the excess deaths in the open interval being used. An iterative procedure that operates on this principle has been devised by Zlotnik (1981) and was applied to the Colombian data. The results are presented in Table 50. Estimates are displayed for each of the growth rates defining Sets 1 and 2 of the stable and quasi-stable parameters (see Table 43).

TABLE 49 Estimated Mean Completeness of Death Registration for Different Truncation Points of the Population, 1964: Colombia

Truncation Age	Estimated Mean Completeness Over Age 5	
	Male	Female
45	0.951	0.944
50	0.951	0.951
55	0.923	0.939
60	0.952	0.986
65	0.901	0.935
70	0.918	0.972
75	0.913	0.972
80	0.928	1.021
85	0.936	1.035

Note: Growth rate for males = 0.0295; females = 0.0296.

Also presented in Table 50 are estimates based on projections consistent with the stable and quasi-stable parameters. These were obtained by dividing the observed death rate over age 15 by the one estimated via projection. Therefore, in strict terms, the projection estimates refer only to deaths over 15. This choice was made because in 1964 the deaths under 15 were more likely to be affected by nonstable conditions and because the completeness of registered deaths at young ages (at both points in time) was likely to be different from that of adult deaths. The last observation applies especially to females, for whom the plateaus were chosen so as to exclude the younger ages.

Comparison of the two types of estimates shows that they are fairly consistent. Overall, the projection estimates derived from Set 2 are closer to the Preston-Coale estimates obtained by redistributing deaths than are the Set 1 projection estimates. If the projection estimates are assumed to be correct, the Preston-Coale estimates tend to slightly underestimate completeness.

TABLE 50 Estimates of Death Registration Completeness Based on Application of the Preston-Coale Method to Redistributed Data,[a] 1951 and 1964: Colombia

	Male[b]		Female	
Parameter	Set 1	Set 2	Set 1	Set 2
1951				
Growth Rate	.0238	.0242	.0238	.0242
Plateau's Range	0-35	0-35	15-30	15-30
Preston-Coale Estimate	.755	.768	.700	.712
Projection Estimate	.786	.788	.747	.748
1964				
Growth Rate	.0300	.0295	.0300	.0296
Plateau's Range	0-35	0-35	20-35	20-35
Preston-Coale Estimate	.819	.800	.794	.776
Projection Estimate	.831	.818	.830	.801

[a]Based on use of Zlotnik (1981) adjustment for age exaggeration, with truncation at age 85; see text for explanation.
[b]An adjusted age distribution was used for 1964.

Although these comparisons do not allow us to establish with certainty the best completeness estimates for 1951 and 1964, they do show that the stable and quasi-stable estimates presented in Tables 39 through 42 are not inconsistent with other evidence, once the deficiencies of the latter are taken into account.

2.3.5 The Special Problems of Estimating Mortality in 1973

To conclude, we consider the case of the 1973 census and death registration around that year. This case has not been mentioned in previous sections for two reasons: in terms of quasi-stable models, the 1973 population does not fit the assumptions underlying them (both fertility

and mortality started to decline prior to 1973); and in terms of intercensal comparisons, not only is there lack of a complete set of registered deaths for the 1964-73 period, but also the population during that period is less likely to be closed. Since both quasi-stable estimates and those yielded by the Preston-Hill method may be severely affected by such departures from their basic assumptions, no attempt was made to apply them. Unfortunately, the arguments just noted could also be used to invalidate the use of the Preston-Coale method. However, its relative simplicity and the fact that recent changes in fertility are not very likely to affect its results, make it worth using, if only for exploratory purposes.

The first problem one faces in trying to apply the Preston-Coale method to the 1973 data is the need to estimate an appropriate growth rate. Since evidence suggests that the 1973 census achieved a considerably lower completeness of coverage than the 1964 census (see Chapter 1), direct calculations of intercensal growth rates are likely to yield seriously biased estimates. However, the 1974 post-enumeration survey (PES) provides some guidelines regarding possible correction factors for the 1973 census count. According to the PES, 92.8 percent of the private-household population in Colombia's departamentos was enumerated by the 1973 census (DANE, 1981). If we take into account that this population excludes all those living in the national territories, in collective dwellings, in Indian reservations, or serving in the armed forces, a 10-percent correction does not seem high. When this correction is applied to the 1973 data and an intercensal growth rate is calculated on the basis of the 1964 unadjusted census count, the value obtained is 0.0283 for both sexes combined. Since the adjustment factors produced by the 1974 post-enumeration survey do not provide a breakdown by sex, and in any case the exclusion of the armed forces implies that males require a greater correction factor than females, we decided to use the same growth rate for the two sexes.

The data used in applying the Preston-Coale method were the 1973 age distribution of the population in private households published in the final 1973 Census Report (DANE, 1981) and the mean age distribution of deaths registered during the years 1972, 1973, and 1974 (DANE, 1977d). Figure 11 plots the age-specific completeness estimates implied by these data. Once more, a certain tendency to overstate age at death is noticed

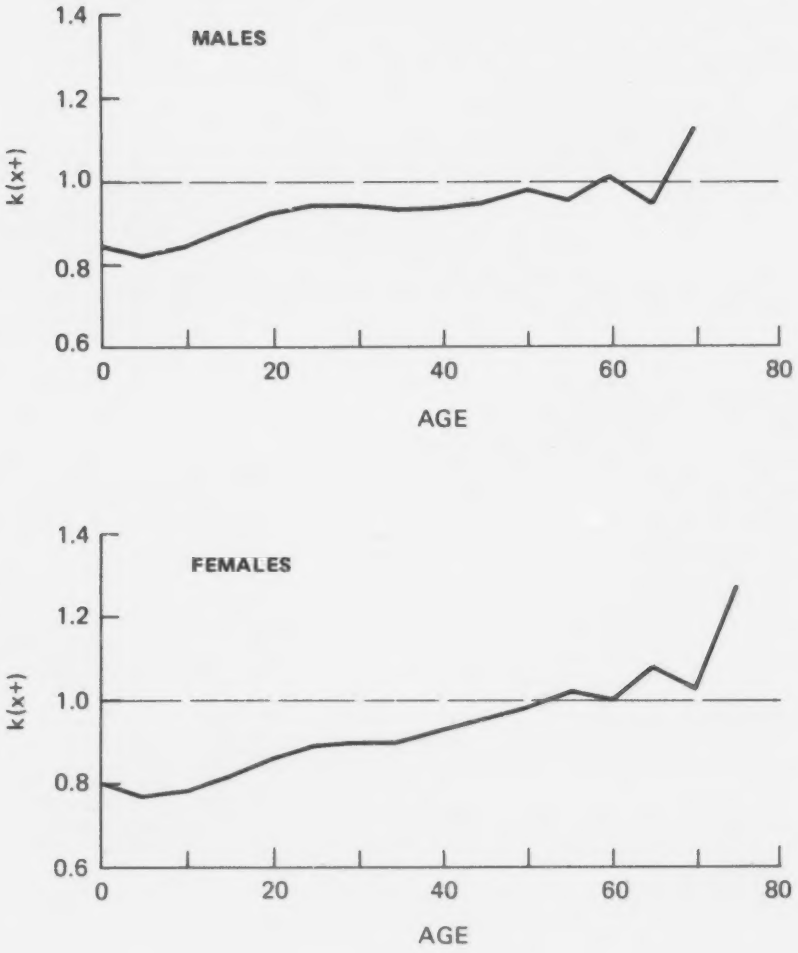


FIGURE 11 Estimated Completeness of Death Registration by Age, Using the Preston-Coale Method Truncated at Age 80, with Growth Rate 0.028, 1973: Colombia

among both males and females. For males, the tendency of completeness estimates to increase as age increases is less marked than for females, and for both sexes the U-shaped curve at younger ages, which was barely suggested in the 1964 plots (Figure 10), has become more accentuated. This initial curvature is caused by deviations from stability.

As in Table 50, the completeness estimates in Figure 11 were derived by applying the Preston-Coale method to

redistributed data, generated by Zlotnik's plateau-based redistribution technique. The plateau for males ranged from ages 10 to 30; for females, it ranged from 20 to 35. The mean of the mean estimates of completeness obtained by truncating the redistributed data at several ages (45 to 85) was accepted as a final completeness estimate. Its value was 0.825 for males and 0.735 for females. Since the general consensus is that completeness of registration deteriorated after the changes made in the vital registration system in the late 1960s, these estimates may seem at first rather high. However, one must remember that they represent death registration completeness with respect to the completeness of enumeration of the 1973 census. Since the latter is certainly less than one, absolute completeness of death registration is lower than the 0.825 and 0.735 values. It is also likely that sex differentials in the completeness of census coverage may be at least partly responsible for the increased sex differential in death registration completeness.

Due to lack of other mortality estimates for the period, it is not possible to compare these 1973 completeness estimates with any others. However, their plausibility can be assessed by using the adjustment factors they imply to estimate a series of adjusted ${}_5m_x$ values. Table 51 shows some of these values and the levels in the "North" family of model life tables to which they correspond. The adjusted ${}_5m_x$ values are far from regular, since they are associated with different mortality levels at different ages. However, the median levels seem reasonable and the similarity between the two sexes is reassuring.

Although we cannot pretend that these estimates of median mortality levels are solid, they may be the best available for the 1970-80 decade. Due to the paucity of data and the defects plaguing the few sources available, the reliability and consistency of estimates for recent periods cannot be tested. There is, therefore, an unavoidable gap in our knowledge about recent adult mortality levels in Colombia.

2.3.6 Estimation of Adult Mortality Based on Orphanhood Information

Data on the maternal orphanhood status of the population were gathered in 1978 by the National Household Survey

TABLE 51 $_5m_x$ Rates Adjusted According to the 1973 Estimated Completeness of Death Registration and the Levels They Imply in the Coale-Demeny North Model Life Tables: Colombia

	Male		Female	
Age x	$_5m_x$	North Mortality Level	$_5m_x$	North Mortality Level
15	.002288	19.92	.001729	19.52
20	.003809	18.94	.002270	19.48
25	.004365	18.38	.002670	19.39
30	.004736	18.90	.003590	18.36
35	.005615	17.69	.004790	17.43
40	.006588	18.00	.006307	16.80
45	.009382	16.83	.008138	15.68
50	.013091	16.67	.011877	14.41
Median		18.19		17.90

Note: Estimated completeness of death registration for males = .825; females = .735.

(NHS). Brass and Hill (1973) were the first to suggest a method to convert the observed proportions orphaned to life-table probabilities of surviving from age 25 to age 25+N (N depending on the age of respondents). Later, Hill and Trussell (1977) proposed a modified version of the original technique, which has been used here to estimate female adult mortality.

Table 52 shows the results of applying this method to the 1978 NHS data. In addition to the observed proportions orphaned, the method requires as input an estimate of the mean age at which women bear their children. This value, denoted by M, was estimated on the basis of the NHS data themselves and is equal to 27.07 years when the data are classified according to standard five-year age groups and to 27.23 when nonstandard age groups (18-22, 23-27, 28-32, etc.) are used.

The use of data classified according to nonstandard age groups has proved effective in reducing biases due to age-heaping (Hill et al., 1982). In the case of mortality estimation based on orphanhood, the systematic over-reporting of age that results from the combination of

TABLE 52 Estimates of Adult Female Mortality Based on Orphanhood Information from the 1978 NHS: Colombia

Age Group	Proportions Not Orphaned	N	$\frac{1(25+N)}{1(25)}$	North Mortality Level (Females)	Time Reference
Standard[a]					
15-19	.9401	20	.9366	19.63	1970.7
20-24	.9187	25	.9182	20.04	1969.0
25-29	.8492	30	.8530	18.08	1967.5
30-34	.7528	35	.7613	16.04	1966.1
35-39	.6668	40	.6799	15.87	1965.1
40-44	.5574	45	.5690	15.72	1964.4
45-49	.4389	50	.4392	16.04	1964.0
Nonstandard[b]					
18-22	.9251	20	.9365	19.62	1969.7
23-27	.8798	25	.8989	18.65	1968.1
28-32	.7969	30	.8344	17.03	1966.7
33-37	.7070	35	.7631	16.12	1965.5
38-42	.6002	40	.6762	15.71	1964.7
43-47	.4823	45	.5710	15.80	1964.2
48-52	.3480	50	.4285	15.63	1963.4

[a] $a_M = 27.07$.
[b] $b_M = 27.23$.

heaping on ages ending in 0 or 5 and the use of five-year age groups starting at those ages leads to an overestimation of the length of exposure to the risk of dying among the respondents' mothers and hence to underestimates of female mortality. In the Colombian data, the existence of such biases can be noticed by comparing the mortality levels associated with equivalent 1(25+N)/1(25) values derived from standard and nonstandard age groups. In general, those associated with the nonstandard groups are lower than those associated with the standard, and it is clear that the time trend implied by the nonstandard estimates is more consistent (closer to being strictly declining) than that implied by the standard age groups.

Mortality estimates derived from orphanhood information do not refer to only one point in time but represent the average mortality experience over some period preceding the survey. Obviously, if mortality had remained fixed, the exact period to which the estimates refer would be irrelevant. But in cases such as the one at hand, where mortality has not been constant and where the estimates themselves suggest some change over time, it is important

to establish precisely the time reference of the estimates obtained.

Brass and Bamgboye (1981) have suggested a method of estimating this reference period. The method assumes that mortality has been changing smoothly and it uses as input the same data as the mortality estimation method (that is, the proportions not orphaned and the mean age of mothers at the birth of their children). The last column in Table 52 shows the time reference estimates associated with each estimated mortality level.

These time references make it possible to compare the mortality estimates in Table 52 with those obtained earlier. In doing so, we have used the estimates derived by using nonstandard age groups, since their biases are likely to be smaller. The obvious comparison possible is that of the mortality level estimated for 1964 and the one obtained on the basis of quasi-stable models. According to Table 52, in 1964 females were subject to a mortality level of about 15.7 or 15.8. According to the Set 1 and Set 2 of estimates in Tables 40 and 42, respectively, the levels in 1964 were 16.1 and 15.6, respectively. Set 2 is closer to the orphanhood-based estimates than Set 1, but the overall consistency is reassuring.

As a check for more recent periods, the mortality estimates derived from the 1973 data (Table 51) can be compared with those derived from orphanhood information about younger respondents. If we accept, as the census data indicate, that level 18 is an appropriate mortality estimate for 1973, the orphanhood estimates whose time reference is close to this point (those associated with age groups 18-22, 23-27 and, even, 28-32) are too high (implying very low mortality). The existence of positive biases in the estimates of mortality level derived from data for young respondents is well documented (Brass and Hill, 1973) and is usually ascribed to the "adoption effect," that is, the tendency of young respondents whose biological mothers have died to report the survival status of their stepmothers. Although it seems somewhat unlikely that the adoption effect would be operating at relatively advanced ages such as 23-27, its residual influence, coupled with some tendency (especially among males) to overstate age may be causing the low mortality estimates observed. In any case, the mortality trend implied by the orphanhood estimates seems suspect even when judged independently: changes of one level or more between time points that are not even two years apart are clearly implausible.

In conclusion, the mortality estimates derived from orphanhood information and referring to years prior to 1966 are acceptable and consistent with other evidence. Those for 1967 and later imply relatively high model mortality levels (i.e. low mortality) that do not seem plausible.

2.3.7 Estimates of Adult Mortality Based on Widowhood

Tables 53 and 54 present estimates of survival probabilities derived from information on the survival of first spouse, gathered by the 1978 NHS. The estimation method used is that presented in U.N. Manual X (United Nations, 1982). Also displayed are the mortality levels implied by each of the estimated survival probabilities within the "North" family of model life tables. Once more, two groupings of the basic data have been used in each case: standard and nonstandard five-year age groups.

A rapid comparison of the levels associated with the survival estimates shows that mortality among mal

TABLE 53 Estimates of Adult Female Mortality Based on Widowhood Information from the 1978 NHS: Colombia

Age Group	Proportion Not Widowed (Males)	N	$\frac{l(N)}{l(20)}$	North Mortality Level (Females)	Time Reference
Standard[a]					
25-29	.9909	25	.9906	20.45	1978.0
30-34	.9883	30	.9878	22.48	1975.7
35-39	.9740	35	.9728	21.22	1973.4
40-44	.9501	40	.9466	19.64	1971.2
45-49	.9274	45	.9244	19.48	1969.2
50-54	.9005	50	.8992	19.42	1967.5
55-59	.8958	55	.9009	21.39	1966.4
Non-Standard[b]					
28-32	.9874	30	.9811	20.78	1976.6
33-37	.9828	35	.9783	22.10	1974.4
38-42	.9643	40	.9560	20.64	1972.1
43-47	.9284	45	.9130	18.59	1969.9
48-52	.9150	50	.9018	19.58	1968.2
53-57	.9048	55	.8935	20.97	1966.8
58-62	.8393	60	.8185	19.24	1965.6

[a] $SMAM_f$ = 22.85; $SMAM_m$ = 26.33
[b] $SMAM_f$ = 22.84; $SMAM_m$ = 26.41

TABLE 54 Estimates of Adult Male Mortality Based on Widowhood Information from the 1978 NHS: Colombia

Age Group	Proportion Not Widowed (Females)	N	$\frac{l(N)}{l(20)}$	North Mortality Level (Females)	Time Reference
Standard[a]					
20-24	.9847	25	.9790	18.09	1978.6
25-29	.9785	30	.9656	19.68	1976.4
30-34	.9646	35	.9497	19.99	1974.1
35-39	.9371	40	.9219	19.18	1971.8
40-44	.8869	45	.8740	17.57	1969.8
45-49	.8250	50	.8174	16.46	1967.9
50-54	.7565	55	.7581	16.14	1966.4
55-59	.6671	60	.6792	15.56	1965.0
Nonstandard[b]					
23-27	.9873	25	.9861	21.04	1977.3
28-32	.9678	30	.9651	19.58	1975.0
33-37	.9469	35	.9450	19.38	1972.7
38-42	.9006	40	.9042	17.51	1970.5
43-47	.8624	45	.8739	17.56	1968.7
48-52	.7763	50	.8043	15.71	1966.9
53-57	.7147	55	.7611	16.28	1965.6

[a] $SMAM_f = 22.85$; $SMAM_m = 26.33$
[b] $SMAM_f = 22.84$; $SMAM_m = 26.41$

(estimated on the basis of answers by female respondents) is consistently higher than that among females, the differential being of at least two mortality levels for each estimate. Several factors may cause such unexpected differentials, including consistent exaggeration of male ages, consistent understatement of female ages, or the fact that males report less accurately the survival of their first spouses than do females. The last is a fairly common cause of bias in populations like Colombia's where consensual unions are frequent and men tend to report the survival status of their current spouse rather than that of their first spouse. Comparison of the dated mortality estimates for females (Table 53) with those derived from orphanhood information (Table 52) shows that the levels obtained from widowhood data are too high, even for the earlier periods. Hence, these estimates have to be rejected.

In contrast, the estimates of male mortality derived from the widowhood status of females (Table 54) are not entirely inconsistent with other estimates of male mortality. Those derived from reports by younger women

(less than 39) are, however, fairly high. Although no estimate refers exactly to 1964, the one derived from age group 55-59, which refers to 1965 (15.56) is fairly close to the estimates derived by using quasi-stable models (15.94 according to Set 1 data and 15.72 according to Set 2 data). However, it is difficult to establish with certainty which of these estimates is "best," and if one rejects the estimates referring to the 1970s, only a rather rough indication of trend can be obtained from those corresponding to the 1960s.

To conclude, we stress that for males the estimated levels for recent periods are unrealistically high, so they do not invalidate the estimates made above on the basis of the 1973 census and death registration data. Estimates for earlier periods seem acceptable, although it is difficult to establish whether the standard or the nonstandard set is better. The consistency between the 1965 estimates and those derived via quasi-stable models is reassuring. The widowhood-based estimates for females, on the other hand, are disappointing. Both their internal inconsistencies (the trend they imply is far from smooth) and their marked deviations from comparable estimates derived from other sources render them highly suspect. Their future use, therefore, is not recommended.

2.3.8 Final Mortality Estimates for 1950-75

In general, the revised stable and quasi-stable estimates of adult mortality presented in Tables 39 through 42 appear satisfactory on the basis of all possible consistency tests. Hence, they have been adopted as basically representative for the 1950-64 period. The evidence referring to subsequent years is both sparse and weaker in nature. The best possible estimates for the 1970-79 decade are probably those derived from the 1973 census and from registered deaths adjusted for underregistration. When interpreted in terms of the "North" family of model life tables, such estimates yield median levels that are both plausible and in line with reliable estimates derived from other sources (orphanhood and female widowhood). Hence, they have also been adopted as satisfactory.

Due to the availability of abundant and better quality data, fairly reliable estimates of childhood mortality can be obtained for the 1965-75 period. Although some estimates are available for years prior to 1965 (see

Table 32), their reliability is open to question, especially because they approximate too closely the flawed infant mortality estimates obtained from vital registration. Compared to those implied by the stable and quasi-stable estimates for the same period, they appear to underestimate mortality.

To produce a complete final series of mortality estimates for the 1950-78 period, we used yearly life tables generated on the basis of stable and quasi-stable estimates of Set 2 (Tables 41 and 42) via linear interpolation within the logit system, with "West" female level 16 as the standard. This set was complemented by a series of yearly life tables for 1964-73, which were obtained by the same process using "North" level 18 for both males and females as an estimate for 1973. A mixed mode of extrapolation was used to prolong the series beyond 1973. Linear change was assumed only until 1975 and from then on the rate of change in mortality was drastically reduced. Uncertainty about the true levels prevalent in the most recent periods made the use of almost unchanging mortality seem reasonable.

Once a series of consistent life tables for the 1950-78 period had been calculated, they were merged with the child mortality estimates for 1962-78 from Table 32. Two levels of consistency were maintained during the merging process: internal consistency of each life table that was generated, and longitudinal consistency of the estimates (in the sense that their trend over time should be reasonable). The first type of consistency was given priority, and therefore a certain roughness was tolerated in the time trend of some parameters. The merging process altered little the final child mortality estimates for females, but it modified the male estimates somewhat more. Table 55 shows our final child mortality estimates by sex for 1950-78.

Table 2 (in the summary at the beginning of the report) presents yearly estimates of the expectation of life at birth, e_0, and of the expectation of life at age 5, e_5, for the 1950-78 period. Abridged life tables, by sex for 1950, 1955, 1960, 1965, 1970, and 1975 appear in Appendix F (Tables F.1 through F.6).

2.3.8.1 *Comparison of Final Mortality Estimates With Earlier Estimates*

Arriaga's estimates of e_0 and e_5 for 1951 (Table 35) are higher than the final estimates presented in Table 2

TABLE 55 Final Child Mortality Estimates by Sex, 1950-78: Colombia

	Female					Male				
Year	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$	$_1q_0$	$_2q_0$	$_3q_0$	$_5q_0$	$_{10}q_0$
1950	.1375	.1740	.1908	.2107	.2322	.1619	.1983	.2147	.2337	.2533
1951	.1347	.1709	.1876	.2072	.2287	.1587	.1948	.2111	.2300	.2497
1952	.1294	.1647	.1811	.2004	.2218	.1524	.1879	.2040	.2227	.2426
1953	.1242	.1589	.1748	.1938	.2151	.1464	.1813	.1971	.2157	.2356
1954	.1193	.1530	.1687	.1874	.2085	.1405	.1748	.1904	.2087	.2287
1955	.1145	.1474	.1628	.1811	.2021	.1349	.1685	.1839	.2020	.2220
1956	.1098	.1419	.1570	.1750	.1958	.1294	.1624	.1775	.1954	.2155
1957	.1053	.1366	.1514	.1690	.1897	.1242	.1565	.1714	.1889	.2090
1958	.1010	.1315	.1460	.1633	.1837	.1191	.1507	.1654	.1827	.2028
1959	.0969	.1266	.1407	.1576	.1779	.1142	.1451	.1595	.1766	.1966
1960	.0924	.1215	.1356	.1522	.1722	.1095	.1397	.1539	.1706	.1906
1961	.0884	.1168	.1307	.1468	.1666	.1049	.1345	.1484	.1648	.1848
1962	.0852	.1128	.1259	.1417	.1612	.1006	.1294	.1430	.1592	.1791
1963	.0829	.1097	.1212	.1367	.1560	.0973	.1212	.1320	.1489	.1735
1964	.0813	.1071	.1167	.1318	.1508	.0942	.1173	.1278	.1442	.1681
1965	.0796	.1045	.1145	.1295	.1483	.0920	.1146	.1249	.1408	.1654
1966	.0777	.1017	.1122	.1268	.1452	.0901	.1120	.1220	.1375	.1623
1967	.0758	.0989	.1076	.1215	.1393	.0875	.1085	.1181	.1329	.1563
1968	.0739	.0962	.1032	.1165	.1336	.0849	.1051	.1142	.1284	.1505
1969	.0717	.0933	.0994	.1124	.1280	.0822	.1016	.1104	.1242	.1449
1970	.0691	.0904	.0962	.1090	.1221	.0793	.0982	.1067	.1201	.1395
1971	.0666	.0876	.0934	.1063	.1165	.0765	.0949	.1032	.1162	.1342
1972	.0642	.0848	.0908	.1038	.1119	.0738	.0917	.0997	.1124	.1291
1973	.0619	.0821	.0881	.1010	.1082	.0712	.0885	.0963	.1087	.1241
1974	.0606	.0807	.0866	.0995	.1066	.0693	.0861	.0937	.1059	.1193
1975	.0603	.0804	.0864	.0993	.1068	.0690	.0858	.0934	.1056	.1189
1976	.0600	.0802	.0861	.0991	.1067	.0687	.0855	.0931	.1053	.1184
1977	.0597	.0799	.0859	.0990	.1066	.0684	.0852	.0928	.1050	.1179
1978	.0594	.0796	.0856	.0988	.1064	.0681	.0849	.0925	.1047	.1175

because they depend on the assumption that mortality started to decline in 1938. Under this assumption, the growth rate for 1951 was greater than the one implicit in our estimates and, coupled with a fixed age distribution, it produces lower estimates of mortality (i.e., greater expectations of life). Although Arriaga's assumption cannot be totally disproved, the similarity between the 1938 and 1951 age distributions (Lopez, 1968) does not suggest that mortality had been changing for a long time by 1951. Furthermore, Arriaga does not address the case of the 1964 population. If his assumptions about declining mortality were correct, mortality in 1964 would be lower than the estimates in Table 2 (since the estimated growth rate for 1964 would be higher than the ones used in Tables 39 through 42). However, as the orphanhood

and female widowhood estimates suggest, this was not the case.

The Table 2 estimates can also be compared to Potter and Ordonez's e_5 estimates for 1938, 1951, and 1973, shown in Table 56. As with Arriaga's estimates, the Potter and Ordonez estimates are higher than those in Table 2, a fact that is not suprising given the positive bias that exaggeration of age at death introduces in the completeness estimates, a bias which was not taken into account by Potter and Ordonez. Even so, the difference between the two sets of estimates for 1973 is small.

A third set of mortality estimates that has been widely used is Bayona's estimates for 1964 and 1973, which were derived via a regression model (Bayona, 1977b). Bayona used data from several departamentos with relatively good data to estimate the parameters of linear equations relating the values of a variable representing the level of "modernization" to estimates of mortality (the overall death rate and the expectation of life at birth). Then, the estimated linear equations were used to predict the mortality parameters prevalent in departamentos with inadequate mortality data. The expectation of life for the country as a whole was obtained in a similar fashion. "South" model life tables were then selected on the basis of the estimated e_0 values, and all other parameters were derived from these life tables. Table 57 displays Bayona's estimates of e_0 and e_5 for the country as a whole. Bayona's e_0 estimates agree fairly well with

TABLE 56 Potter and Ordonez's Estimates of Death Registration Completeness and e_5 by Sex, 1951, 1964, and 1973: Colombia

	Male		Female	
Year	Completeness	e_5	Completeness	e_5
1951	.870	54.9	.865	57.5
1964	.880	59.7	.880	63.2
1973	.740	61.1	.740	64.8

Source: Potter and Ordonez (1976).

TABLE 57 Bayona's Estimates of e_0 and e_5 by Sex, 1964 and 1973: Colombia

	Male		Female	
Year	e_0	e_5	e_0	e_5
1964	53.66	59.82	56.99	62.79
1973	57.14	61.82	60.82	65.07

Source: Bayona (1977b).

those in Table 2, but his e_5 estimates are higher than the Table 2 values. This discrepancy arises because the model chosen by Bayona to represent mortality, namely "South", does not approximate adequately true mortality experience in Colombia. In fact, it is interesting to note that even though Bayona himself asserts that the estimates proposed by Potter and Ordonez are too high, his own e_5 values are, in general, higher. Therefore, although the e_0 estimates he proposes seem reasonable, it seems unwise to use any other parameters derived from his set of life tables.

Finally, we consider the U.S. Bureau of the Census (1979) estimates of e_5 in 1973: 59.8 for males and 63.3 for females. These estimates are very close to those in Table 2, but the corresponding e_0 estimates (57.1 for males and 60.8 for females) are noticeably lower than those in Table 2 (58.09 and 61.68, respectively). The reason for this discrepancy is that the child mortality estimates proposed by the U.S. Bureau of the Census are derived via the "West" model which, as illustrated earlier in this chapter, does not adequately represent recent Colombian mortality.

Thus, most of the discrepancies observed between the final set of mortality estimates presented here and those proposed elsewhere can be attributed to known causes of error. No evidence of serious and consistent biases in the set proposed here could be found.

2.4 SUMMARY

Mortality levels in Colombia have declined consistently during the past three decades. From 1950 to 1975 the country experienced on average annual gain in the expectation of life at birth of approximately 0.60 years for males and 0.62 years for females. A substantial proportion of these gains was due to large declines in childhood mortality. During the same period, infant mortality decreased by some 57 percent, while the reduction in mortality from birth to age 5 amounted to about 55 percent. Although reliable estimates for the most recent years are not yet available, it is likely that this decline has continued.

3

ESTIMATION OF FERTILITY

According to all available estimates, Colombia has experienced a rapid decline in fertility during the past 15 years. This decline was first documented by the analysis of the 1969 NFS data (ASCOFAME, 1973b). Data from the 1973 census sample confirmed it (Potter and Ordonez, 1976; Potter et al., 1976; DANE, 1976a), as did the data gathered by all the more recent surveys (1976 CFS, 1978 Contraceptive Prevalence Survey, and 1978 NHS). The fact that a decline has taken place is undeniable, but uncertainties remain about what the current level is and about what the level was before the decline began.

In this chapter the available evidence is examined in an attempt to find the best answer to these two questions. Estimates of fertility levels and trends have been obtained essentially from three types of information: fertility histories; births in a given year and parity reports; and the enumerated children, classified by age of child and age of mother.

3.1 DATA FROM FERTILITY HISTORIES

The fertility history (or maternity history) of a woman is a list of the children she has borne and the times at which they were born. Information about pregnancies not resulting in live births may also be included, together with information about the survivorship status of each child. Fertility histories are usually recorded by means of fairly lengthy questionnaires. Two surveys that gathered fertility histories have been carried out at the national level in Colombia: the 1969 NFS and the 1976 CFS.

3.1.1 Data from the 1969 NFS

In principle, fertility history information is ideal for studying fertility levels and trends through time. In practice, however, errors often present in the data lessen their value. Therefore a thorough scrutiny of the data's quality is necessary before accepting the validity of estimates derived from them. In the case of Colombia, it seems fair to say that only the CFS data have been subjected to deep scrutiny. Lack of adequate tabulations has prevented more thorough analysis of the NFS data, summarized in Tables 58 and 59. For example, detailed estimates of age-specific fertility rates by five-year cohorts are available only for rural areas. For urban areas, the published age-specific fertility rates by five-year periods cover only the 10 years preceding the survey, so it is not possible to estimate cohort fertility. This limitation severely reduces the possibilities for assessing the overall quality of the data.

Yet, even from these sketchy tabulations, some conclusions can be drawn. For example, notice how for every age group in the rural section of Table 58 the rates in the earliest period are the lowest (except for age group 40-44). This would imply that the 1934-38 cohort (women aged 45-49 in 1969 who were at the beginning of their childbearing--ages 15-19--in 1934-38) had lower fertility than its successors. In addition, according to Table 59 the average number of children reported by this cohort is similar to the average reported by the 1944-48 cohort (women aged 35-39 in 1969), even though the latter was 10 years younger at the time of interview. Since the increase in fertility that this implies is so unlikely, one must search for a more plausible explanation of the reported data. Event omission by older women, an error commonly observed in fertility-history data, is a possible one. The fact that mortality levels estimated from NFS data are also too low (see Figure 4) supports this possibility.

Further evidence in its support is obtained from the 1976 CFS data. Table 60 compares the period estimates of age-specific fertility rates derived from the NFS with those from the CFS maternity history data. In most cases the CFS estimates are higher. The differences in terms of fertility cumulated to age 35 imply that the NFS underestimated fertility by about 3 percent in the last two periods. For 1960-64, the agreement between the two sources is much closer.

TABLE 58 Age-Specific Fertility Rates by Five-Year Periods from the 1969 NFS: Colombia

Period	Age Group 15-19	20-24	25-29	30-34	35-39	40-44	45-49
Rural[a]							
1934-38	.083	--	--	--	--	--	--
1939-43	.126	.255	--	--	--	--	--
1944-48	.154	.303	.318	--	--	--	--
1949-53	.154	.316	.331	.322	--	--	--
1954-58	.158	.334	.355	.343	.258	--	--
1959-63	.144	.333	.385	.331	.265	.112	--
1964-68	.143	.323	.361	.323	.257	.109	.026
Urban[b]							
1959-63	.117	.265	.284	.270	.188	--	--
1964-68	.096	.227	.242	.204	.134	.071	--
Total[b]							
1959-63	.129	.299	.337	.304	.230	.098	--
1964-68	.118	.270	.229	.272	.195	.090	.010

Sources: [a]ASCOFAME (1973a:208).
[b]Pierret (1979:6, 8).

An additional set of estimates based on the 1969 NFS is the period age-specific fertility rates calculated by Elkins for 1960-68 (ASCOFAME, 1973b), which appear in Tables 61 and 62. As expected, rural fertility is higher than urban fertility, and fertility is indeed declining over time. Notice, however, that the total fertility rate estimated for 1968-69 (shown in Table 61) is about 12 percent higher than that for 1967-68. The data upon which the 1968-69 estimates are based were also gathered by the 1969 survey but were tabulated only recently (Ochoa and Ordonez, 1980). These estimates, although internally consistent, are higher than those derived from other sources for the same period, in spite of the general downward bias that seems to affect the other NFS estimates.

TABLE 59 Reported Average Parity from Fertility Histories of the 1969 NFS: Colombia

Age Group	Rural[a]	Urban[a]	Total[b]
15-19	0.2	0.2	0.20
20-24	1.5	1.1	1.27
25-29	3.2	2.4	2.85
30-34	5.1	3.5	4.43
35-39	6.6	4.8	5.78
40-44	7.3	5.7	6.60[c]
45-49	6.8	5.6	6.30[c]

Sources: [a]ASCOFAME (1973a:204).
[b]Hobcraft (1980:50).
[c]CCRP (1980:15).

The reasons for this puzzling outcome are unknown, but they may be related to the character of the NFS sample.

3.1.2 Data from the 1976 CFS

Detailed analysis of the CFS maternity history data have shown them to be adequate. In particular, Hobcraft (1980) showed that estimates derived from these data are consistent with those derived from other sources, including the CFS own household survey, the 1973 census, and the 1969 NFS. Table 63 presents the total and age-specific fertility rates by time period estimated from the CFS maternity histories. One problem underlying these data is that arising from truncation at the time of interview (only women 15 to 49 in 1976 were eligible for individual interview). The further one moves into the past, the more the recorded fertility experience is curtailed, so comparisons with other data sources become more difficult and unreliable (estimates for earlier periods are based on fewer recorded events and are therefore subject to greater variability). To enhance the possibilities for comparison, some values presented in Table 63 were derived by using the experience of cohorts whose recorded fertility experience was more complete to estimate the missing rates.

TABLE 60 Comparison of Age-Specific Fertility Rates for Different Periods, Estimated from CFS and NFS Data: Colombia

Age Group	Period 1960-64 CFS	1960-64 NFS	1965-66 CFS	1965-66 NFS	1967-68 CFS	1967-68 NFS
15-19	.131	.129	.146	.125	.110	.110
20-24	.308	.299	.301	.270	.287	.270
25-29	.340	.337	.302	.321	.314	.278
30-34	.300	.304	.265	.267	.253	.277
35-39	--	.230	.230	.214	.204	.176
Cumulated Fertility						
20	0.655	0.645	0.730	0.625	0.550	0.550
25	2.195	2.140	2.235	1.975	1.985	1.900
30	3.895	3.825	3.745	3.580	3.555	3.290
35	5.395	5.345	5.070	4.915	4.820	4.675
40	--	6.495	6.220	5.985	5.840	5.555

Source: Hobcraft (1980:50).

3.2 DATA ON AVERAGE PARITY AND BIRTHS OCCURRING DURING A GIVEN YEAR

Data on births occurring during a given year, gathered by either a survey or a census, have become the most widely used source of period fertility estimates. Part of their success is due to the existence of the Brass P/F ratio method (see glossary), an estimation technique that checks the consistency and adjusts the deficiencies of observed data.

Unfortunately, the adjusting capabilities of the Brass P/F ratio method are heavily dependent on the assumption of constant fertility. In cases where a decline in fertility is suspected, the method becomes a valuable confirmatory tool but loses its power to measure deficiencies.

At present, there is no P/F-type method available that can adjust current fertility when fertility levels have been declining. However, a variation of the original P/F method that comes close to satisfying these requirements

TABLE 61 Age-Specific Fertility Rates for Different Periods from the 1969 NFS: Colombia

Age Group	Period 1960-64	1965-66	1967-68	1968-69
15-19	.129	.125	.110	.099
20-24	.299	.270	.270	.269
25-29	.337	.321	.278	.305
30-34	.304	.267	.277	.275
35-39	.230	.214	.176	.247
40-44	.098[a]	.095	.085	.128
45-49	.010[b]	.010[b]	.010[a]	.025
Total Fertility Rate	7.035	6.510	6.030	6.740

[a]Adjusted.
[b]Projected from later period.

Sources: 1960-64, 1965-66, and 1967-68: ASCOFAME (1973b:31). 1968-69: Ochoa and Ordonez (1980:5).

is the first-birth P/F ratio method, an analog of the usual Brass method applied only to first-birth data (United Nations, 1982). Its use for adjusting observed current fertility depends on two assumptions: that first births are under- or overreported to the same degree as those of other orders and that the first-birth age-specific fertility rates have remained constant. In the case of Colombia there is no direct evidence substantiating either of these hypotheses. The second assumption might be violated if age at first marriage had been changing. Unfortunately, data on marital status and age at marriage in most of Colombia's data sources have been poor. Both the relatively high incidence of consensual unions and the use of various definitions when data on this subject were gathered have contributed to the many inconsistencies observed in the available information. However, the best evidence available (obtained from the nuptiality histories gathered by the CFS) shows that the mean age at first marriage has remained almost unchanged during the last 20 or 30 years (Florez and Goldman, 1980). Therefore, at least on these grounds, there is no reason

TABLE 62 Rural and Urban Age-Specific Fertility Rates for Different Periods from the 1969 NFS: Colombia

Age Group	Period 1960-64	1965-66	1967-68
Urban			
15-19	.117	.099	.093
20-24	.265	.241	.214
25-29	.284	.261	.223
30-34	.270	.206	.201
35-39	.188	.150	.118
40-44	.082[a]	.078	.064
45-49	.004[b]	.004[b]	.004[a]
Total Fertility Rate	6.050	5.195	4.585
Rural			
15-19	.144	.159	.132
20-24	.331	.300	.336
25-29	.382	.373	.331
30-34	.331	.320	.340
35-39	.263	.265	.223
40-44	.111[a]	.107	.102
45-49	.016[b]	.016[b]	.016[a]
Total Fertility Rate	7.890	7.625	7.400

[a]Adjusted.
[b]Estimated from previous periods.

Source: ASCOFAME (1973b:31).

TABLE 63 Estimated Age-Specific Fertility Rates from Individual Maternity Histories from the 1976 CFS: Colombia

Calendar Year	Total Fertility	Age Group 15-19	20-24	25-29	30-34	35-39	40-44	45-49
1976	4.47	.1015	.2335	.1929	.1657	.1151	.0640	(.0218)
1975	4.56	.0904	.2013	.2351	.1751	.1401	.0471	[.0222]
1974	4.28	.0997	.2265	.2024	.1485	.1073	.0505	[.0209]
1973	4.69	.1034	.2288	.2210	.1734	.1293	.0601	[.0229]
1972	5.05	.1067	.2564	.2282	.1842	.1376	.0728	[.0246]
1971	5.34	.1157	.2586	.2544	.2014	.1438	[.0682]	[.0260]
1970	5.71	.1197	.2649	.2908	.2075	.1591	[.0730]	[.0279]
1969	5.89	.1075	.2698	.2771	.2314	.1881	[.0752]	[.0287]
1968	6.79	.0966	.2741	.3303	.2958	.2406	[.0867]	[.0331]
1967	5.81	.1235	.3006	.2603	.2084	.1668	[.0742]	[.0283]
1966	6.60	.1305	.3138	.2840	.2748	[.2008]	[.0843]	[.0322]
1965	6.75	.1629	.2874	.3200	.2555	[.2053]	[.0862]	[.0329]
1964	7.06	.1160	.3283	.3461	.2821	[.2147]	[.0902]	[.0344]
1963	6.93	.1206	.3022	.3507	.2799	[.2108]	[.0885]	[.0338]
1962	7.01	.1385	.3059	.3136	.3077	[.2133]	[.0896]	[.0342]
1961	- -	.1338	.2892	.3425	(.3077)			
1960	- -	.1547	.3148	.3451	(.3357)			
1959	- -	.1287	.3109	.2982	(.3096)			
1958	- -	.1437	.3292	.3609	(.3574)			
1957	- -	.1318	.2610	.2960	(.4437)			
1956	- -	.1429	.3214	(.3657)				
1955	- -	.1401	.3115	(.3061)				
1954	- -	.1351	.3005	(.3320)				
1953	- -	.1156	.3238	(.2918)				
1952	- -	.1173	.2960	(.3170)				
1951	- -	.1078	(.2295)					
1950	- -	.1524	(.2798)					

Note: ( ) indicates that the cohort experience was incompletely recorded. [ ] indicates that data were estimated by prorating the rates observed in previous calendar years.

Source: Hobcraft (1980:42).

to expect that first-birth fertility at younger ages has changed during that period.

Finally, even when fertility has been changing, a P/F-type method can be used to both explain and adjust fertility estimates whenever data on births in a year and on average parity are available for two points in time approximately five years apart (Zlotnik and Hill, 1981). When the data are adequate, the use of synthetic or hypothetical cohorts subject to the intersurvey or intercensal fertility experience of the population make it possible to estimate an adjusted fertility schedule for the intersurvey period. Application of this tech-

nique usually highlights inadequacies in the data so its use is always valuable for exploratory purposes.

In Colombia, data on births occurring during the year prior to the survey have been gathered by the 1969 NFS, the 1973 census, the 1976 CFS at the household level, the 1978 NHS and the 1978 Contraceptive Prevalence Survey. The data from each of these sources are discussed in the following sections.

3.2.1 The 1969 National Fertility Survey

Ochoa and Ordonez (1980) estimated a fertility schedule for the year preceding the 1969 survey using information about births occurring during that year as reported in the maternity histories (Table 61). These data are sufficient to estimate the values of F (United Nations, 1982) and since information on the average parity of the interviewed women has also been published (Table 59), it is possible to assess the consistency of the data using the P/F ratio method. Table 64 shows the P/F ratios obtained. With the exception of the P(1) and P(7) values, the consistency between the two sets P and F is very good. The slight rise in the P/F ratios as age increases suggests some change in fertility, but the increase is too small to conclusively indicate a trend.

The estimated age-specific fertility rates displayed in Table 64 [f(i)] have been adjusted only to account for

TABLE 64 Application of the P/F Ratio Method to the 1969 NFS Data: Colombia

Age Group	i	Parity[a] P(i)	Fertility[b] F(i)	P/F	Estimated f(i)
15-19	1	0.20	0.22	0.93	0.1176
20-24	2	1.27	1.27	1.00	0.2801
25-29	3	2.85	2.76	1.03	0.3054
30-34	4	4.43	4.19	1.06	0.2722
35-39	5	5.78	5.52	1.05	0.2399
40-44	6	6.60	6.41	1.03	0.1142
45-49	7	6.30	6.71	0.94	0.0186

Sources: [a]Hobcraft (1980:50).
[b]Ochoa and Ordonez (1980).

the fact that the rates proposed by Ochoa and Ordonez (Table 61) probably refer to women who at the time of their most recent birth were on average half a year younger than at the time of interview. A procedure for making half-year adjustments, including the necessary equations and weighting factors, is described in U.N. Manual X (United Nations, 1982). The total fertility implied by the adjusted rates is 6.74, which, as noted above, differs substantially from that estimated by Elkins for 1967-68 (6.03). Deeper scrutiny of the NFS data, probably requiring retabulations of the raw data, would be necessary to establish the causes of this discrepancy. Faced with the impossibility of carrying out such an exercise, we simply note that although the results in Table 64 attest to the internal consistency of the 1968-69 data, problems relating to the NFS sampling scheme and other inconsistencies in the overall data set lead us to doubt the validity of any estimates derived from this source.

3.2.2 The 1973 Census Sample

The 1973 census included two questions on fertility: number of children ever born and date of most recent live birth. Tabulations of these data have only been made on the basis of the advance census sample (see Chapter 1), and variations in the treatment of the basic data have led to nontrivial differences between the published sets. Some of these differences may stem from the treatment of women of not-stated parity when calculating age-specific fertility rates or mean numbers of children ever born. Both the addendum to the advance census sample (DANE, 1977b) and the final census results (DANE, 1981) show the number of women who provided valid responses to the fertility questions. According to both sources, there was a fairly large incidence of nonresponse. Table C.1 of Appendix C shows the levels derived from the census sample. (Those from the final count are very similar and are not displayed.) The high correlation between the proportions of nonrespondents classified by age and the proportions of women who declared having no children suggests that most of the cases of nonresponse were, in fact, coding errors: no entry was marked for women who declared having zero children. This type of error arises frequently in censuses and surveys. El-Badry (1961) has proposed a method to adjust parity information by esti-

mating the true level of nonresponse. Its application to the 1973 census sample is shown in Figure C.1 [illegible] Appendix C.

Another source of discrepancy is the fact that fertility rates calculated directly from the number of births occurring during the year preceding the census and the number of women classified according to their reported age at the time of the census refer to age groups shifted by half a year (since the women who had a child during the year in question were, on average, half a year younger at the time of the birth than at the time of the census). It is possible to adjust these rates for this half-year age shift (United Nations, 1982). Therefore, differences in the age-specific fertility rates obtained from different sources may result from the fact that some sets incorporate this adjustment while others do not.

The two panels of Table 65 illustrate these differences. All the rates in Part A refer to age groups shifted by half a year, while those in Part B refer to the standard age groups, adjusted for this shift. Potter and Ordonez (1976) adopted the adjusted rates shown in column 2 of Table 65 as representative of fertility in Colombia during 1972-73, whereas DANE (1976a) adopted the unadjusted rates (Part A, column 3). Because one set is adjusted and the other is not, their direct comparison is unwarranted. Comparison of sets that are equally adjusted (or unadjusted) shows that the DANE estimates are consistently higher than those by Potter and Ordonez. There are two possible causes for this discrepancy: Potter and Ordonez use all women as denominator and adjust the number of births so that they refer exactly to a 12-month period (the date of the most recent birth was coded only by month and year, hence some type of adjustment is necessary to estimate the number of births occurring between October 24, 1971 and October 23, 1973, the day before the census date). DANE (1976a) does not indicate what adjustments were made in calculating the rates, but if births for a period slightly longer than a year were included or if only women with valid responses to the question on date of most recent birth were used as denominator, the observed descrepancies would be expected.

A more serious inconsistency between the different sources of data from the 1973 census sample is noticed when fertility rates are calculated by dividing the number of births in the year preceding the census (DANE, 1976a:38) by the number of women in the sample (DANE, 1975a:25). The last column of Table 65 shows the results

TABLE 65 Comparison of Age-Specific Fertility Rates Calculated on the Basis of the 1973 Census Sample: Colombia

Age Group	Potter and Ordonez[a]	DANE[b]	Calculated from Published Data[c]
Part A: Observed Data			
14.5-19.5	.063	.065	.070
19.5-24.5	.200	.207	.226
24.5-29.5	.206	.213	.233
29.5-34.5	.176	.183	.201
34.5-39.5	.135	.145	.160
39.5-44.5	.068	.072	.080
44.5-49.5	.023	.024	.027
Part B: Rates Adjusted for Half-Year Age Shift			
15-19	.077	.079	.086
20-24	.207	.215	.235
25-29	.205	.212	.232
30-34	.172	.179	.197
35-39	.130	.140	.154
40-44	.063	.065	.072
45-49	.019	.019	.021
Total Fertility Rate	4.365	4.545	4.984

Sources: [a]Potter and Ordonez (1976:386).
[b]DANE (1976a:43).
[c]DANE (1975a:25; 1976a:38).

obtained. Both the adjusted and the unadjusted rates are consistently greater than either the DANE estimates or the ones by Potter and Ordonez, producing a total fertility rate that is at least 10 percent higher than the other two. No documented explanation has been found for this unexpected outcome. It is suspected, however, that the weighting schemes used in producing the 1975 and the 1976 tabulations may have been different.

These observations raise questions about the true meaning of the published figures. In order to establish which sets are valid estimates of fertility as measured by the 1973 census sample, age-specific fertility rates were recalculated from the basic data[3] and are presented in Table 66. The numerators of these rates were adjusted to reflect only those births occurring between October 24, 1972 and October 23, 1973, and rates were derived using as denominator either all women or the number of

TABLE 66 Age-Specific Fertility Rates Recalculated from the Original 1973 Census Sample: Colombia

	Denominator of Rate	
Age Group	All Women	Women as Adjusted by El-Badry Method
Part A: Observed Rates		
14.5-19.5	.064	.065
19.5-24.5	.204	.206
24.5-29.5	.210	.213
29.5-34.5	.180	.182
34.5-39.5	.138	.140
39.5-44.5	.069	.070
44.5-49.5	0.24	.024
Part B: Rates Adjusted for Half-Year Age Shift		
15-19	.079	.080
20-24	.211	.214
25-29	.209	.211
30-34	.176	.179
35-39	.133	.134
40-44	.063	.064
45-49	.019	.019
Total Fertility Rate	4.447	4.503

women that resulted after applying El-Badry's adjustment techniques (see Appendix C). The second set is almost identical to that published by DANE (1976a). It indicates that total fertility during 1972-73 was 4.503. From here on, this set will be adopted as the "unadjusted" measure of current fertility yielded by the 1973 census.

Table 67 shows average parities by age using the adjusted number of women as denominator (see Appendix C), the F values obtained from the age-specific rates presented in Part A, column 3 of Table 66 by using the method described in U.N. Manual X (United Nations, 1982), and the corresponding P/F ratios. As expected, these ratios show an increasing trend with age, indicating that the 1973 census data are consistent with a decline in fertility.

First-birth age-specific fertility rates based on the 1973 census sample were published by Potter and Ordonez (1976). In fact, these authors were first to apply a version of the first-birth P/F ratio method to such data. However, they attributed the results obtained to the effects of changing age at marriage. Yet, as we pointed out above, the only reliable and consistent data set on nuptiality in Colombia (the 1976 CFS) shows no evidence in support of the existence of such a change

TABLE 67 Application of the P/F Ratio Method to the 1973 Census Sample: Colombia

Age Group	Observed Parity P(i)	Estimated Parity F(i)	P(i)/F(i)
15-19	0.144	0.137	1.05
20-24	1.050	0.924	1.14
25-29	2.440	2.003	1.22
30-34	3.935	2.984	1.32
35-39	5.107	3.774	1.35
40-44	5.866	4.243	1.38
45-49	6.108	4.475	1.36

Note: The denominator used are women as adjusted by the El-Badry method (see Appendix C).

(Florez and Goldman, 1980). Hence, the results of the first-birth P/F ratio technique should not be automatically discarded as indicators of the degree of reference-period error in the data.

Table 68 shows the results obtained by applying a revised version of the first-birth P/F ratio method (United Nations, 1982) to the 1973 census data. These results are fairly similar to those reported by Potter and Ordonez, indicating that there may be an understatement of about 12-percent in the births reported for the year preceding the census (taking the mean of the P_1/F_1 ratios for age groups 20-24 to 40-44). An adjustment of this magnitude would raise the observed total fertility rate from 4.50 to 5.04 children per woman.

3.2.3 The 1976 Colombian Fertility Survey

The 1976 CFS included two types of questionnaires: a household form, which was a general-purpose demographic survey that gathered information about all the members of a household, and an individual form, which recorded detailed maternity histories. The household form included questions on parity and date of most recent

TABLE 68 Application of the First-Birth P/F Ratio Method to the 1973 Census Sample: Colombia

Age Group	Observed Proportions of Mothers[a] $P_1(i)$	First-Birth Age-Specific Rates[a] $f_1(i)$	Estimated Proportions of Mothers $F_1(i)$	$P_1(i)/F_1(i)$
15-19	.105	.043	.097	1.09
20-24	.473	.068	.428	1.10
25-29	.726	.030	.656	1.11
30-34	.835	.011	.742	1.13
35-39	.869	.004	.771	1.13
40-44	.876	.004	.790	1.11
45-49	.869	.002	.808	1.08
Mean				1.11

Source: [a]Potter and Ordonez (1976:387).

birth that were posed to all women aged 15 and over in the household. In his detailed analysis of the CFS fertility data, Hobcraft (1980) applied the P/F ratio method and the first-births method to the data classified by education of mother. Table 69 presents the results of applying the P/F ratio method to data on all births and all women. As expected, the P/F ratios increase with age, indicating that fertility has been declining. Table 70 shows the results of applying the first-birth P/F ratio method to the same data. The results suggest that the CFS data are fairly consistent and that their reference-period error is small (since the ratios in the last column are all close to 1.0).

Given the richness of the CFS data, these are not the only consistency checks possible. For example, it is possible to compare the household survey reports about women who were subsequently interviewed at the individual level with the responses they themselves furnished in the individual survey. Furthermore, because some fertility information was gathered about every eligible woman in the household, the characteristics of those not selected for individual interviews can also be studied.

In theory, every woman aged 15 to 49 had the same probability of being selected for an individual interview, so one expects no systematic differentials between the

TABLE 69 P/F Ratio Method Applied to Data from the CFS Household Interviews: Colombia

Age Group	Observed Parity[a] P(i)	Observed Fertility[a] f(i)	Estimated Parity[a] F(i)	P(i)/F(i)
15-19	0.17	.072	0.153	1.11
20-24	1.11	.213	1.985	1.13
25-29	2.46	.203	2.041	1.21
30-34	3.92	.175	2.980	1.32
35-39	5.27	.134	3.746	1.41
40-44	6.33	.057	4.155	1.52
45-49	6.60	.020	4.347	1.52

Source: [a]Hobcraft (1980:16, 18).

eligible women who were actually interviewed and the ones who were not. However, these expectations do not hold in practice. According to the data presented in Table 71, women who were selected for individual interview had experienced, on average, slightly higher current fertility rates than those who were not selected. However, the parities of the two groups, as recorded at the household level, were not too different. Similar, but remarkable differences were noticed when the parities recorded at the household level for women who were later interviewed individually were compared with the ones derived from the individual interview. For age groups 25-29 and 30-34 the parities declared at the individual level are higher than those declared at the household level, but for the next two age groups the differential reverses itself. One can only speculate about the causes of these differences, but they are likely to stem from inconsistencies between the age reports in the two sources or from event omission in one of them.

Tables 72 and 73 present the data according to their source (household or individual) and according to whether information about a woman was obtained from the woman herself or from another respondent (proxy) at the household level. (There was no proxy reporting in the individual interviews; all women interviewed individually had to answer the questionnaire personally.) According to Table 72, self-reporting women at the household level were more likely to have experienced high current fertility rates. Women whose information was obtained from a proxy had experienced consistently lower fertility, whether measured on the basis of the proxy respondents' information or on the basis of the information supplied by the women themselves. In fact, when women reported about themselves, their current fertility levels appeared to be even lower than those reported by the proxy. Similar comments apply to the data on average parity in Table 73. These findings are of special importance because they indicate that information obtained from proxy respondents is not worse than that gathered from the women themselves and that, if anything, proxy respondents tend to exaggerate the number of events rather than omit them. Furthermore, this evidence suggests that surveys focusing on individual women may tend to overestimate fertility due to biases caused by selective nonresponse; that is, women whose information is provided by proxy respondents are probably more likely to be away from home and to have fewer children.

This brief assessment shows that even though the internal consistency of the CFS data is not perfect, the inconsistencies observed are minor. Evaluating the household data via the two variants of the P/F ratio method reinforces their credibility. Therefore, both the individual and the household data will play important roles in our overall assessment of fertility levels.

3.2.4 The 1978 National Household Survey

The NHS included a question on date of last birth, whose answers were tabulated originally by age of mother and time of occurrence, defined as years ending on May 31 (DANE, 1980). Since the NHS field work took place between June 12 and July 2, 1978, the published tabulations do

TABLE 70 First-Birth P/F Ratio Method Applied to Data from the CFS Household Interviews: Colombia

Age Group	Observed Proportions of Mothers $P_1(i)$	First-Birth Age-Specific Rates $f_1(i)$	Estimated Proportions of Mothers $F_1(i)$	$P_1(i)/F_1(i)$
15-19	.112	.050	.114	0.98
20-24	.524	.079	.504	1.04
25-29	.751	.030	.748	1.00
30-34	.873	.013	.839	1.04
35-39	.889	.006	.879	1.01
40-44	.899	.004	.905	0.99
45-49	.899	.000	.910	0.99
Mean				1.01

TABLE 71 Estimates of Current Fertility and Parity from the 1976 CFS: Colombia

	Household Survey			Individual Survey
Age Group	All Women	Women Selected For Individual Interview	Women Not Selected	f(i)
Part A. Age-Specific Fertility Rates				
15-19	.072	.070	.074	.063
20-24	.213	.208	.216	.204
25-29	.203	.208	.199	.209
30-34	.175	.186	.167	.182
35-39	.134	.149	.123	.136
40-44	.057	.075	.043	.076
45-49	.020	.013	.025	.025
Total Fertility Rate	4.370	4.545	4.235	4.475
Part B. Age-Specific Average Parity				
15-19	0.17	0.17	0.17	0.17
20-24	1.11	1.12	1.10	1.10
25-29	2.46	2.43	2.48	2.44
30-34	3.92	3.97	3.88	4.05
35-39	5.27	5.16	5.35	5.04
40-44	6.33	6.24	6.40	6.08
45-49	6.60	6.75	6.50	6.74

Source: Hobcraft (1980:16, 18).

TABLE 72 Effect of Proxy Reporting on Estimates of Current Fertility Based on Births in the Last Year from the 1976 CFS: Colombia

Age at Survey	Proportions Reporting a Birth in Year Prior to the Survey					
	Women Reported in Both Surveys (Unweighted)					
	Proxy-Reported in Household Survey		Self-Reported in Household Survey		All Women Reported in Household Survey (Weighted)	
	Household Survey Report (Proxy)	Individual Survey Report (Self)	Household Survey Report (Self)	Individual Survey Report (Self)	Reported by Proxy	Reported by Self
15-19	.025	.025	.162	.144	.030	.158
20-24	.129	.128	.257	.265	.113	.284
25-29	.126	.129	.234	.244	.128	.230
30-34	.134	.147	.194	.199	.109	.189
35-39	.153	.133	.147	.143	.098	.145
40-44	.027	.057	.085	.089	.020	.069
45-49	.000	.001	.018	.021	.015	.022
Total Fertility Rate	2.970	3.100	5.485	5.525	2.565	5.485

Source: Hobcraft (1980:17, Table 2.2).

TABLE 73 Effect of Proxy Reporting on Estimates of Current Average Parity from the 1976 CFS: Colombia

Age at Survey	Women Reported in Both Surveys (Unweighted): Proxy-Reported in Household Survey: Household Survey Report (Proxy)	Women Reported in Both Surveys (Unweighted): Proxy-Reported in Household Survey: Individual Survey Report (Self)	Women Reported in Both Surveys (Unweighted): Self-Reported in Household Survey: Household Survey Report (Self)	Women Reported in Both Surveys (Unweighted): Self-Reported in Household Survey: Individual Survey Report (Self)	All Women Reported in Household Survey (Weighted): Reported by Proxy	All Women Reported in Household Survey (Weighted): Reported by Self
15-19	0.07	0.07	0.40	0.37	0.08	0.36
20-24	0.61	0.56	1.52	1.52	0.57	1.56
25-29	1.44	1.44	2.90	2.89	1.53	2.93
30-34	2.95	2.88	4.27	4.36	2.67	4.33
35-39	4.00	4.09	5.46	5.29	3.97	5.73
40-44	5.68	5.23	6.42	6.40	5.87	6.53
45-49	6.37	6.58	6.89	6.79	5.85	6.92

Source: Hobcraft (1980:18, Table 2.4).

not actually cover the year immediately preceding the survey. Fortunately, the raw survey data are available and retabulation was possible. Table 74 shows a comparison of the age-specific fertility rates obtained from the data tabulated by DANE and those obtained by considering all births occurring during the year preceding interview. Notice that the latter imply a slightly higher total fertility rate and that the difference (about 5.4 percent) can be accounted for totally by the fact that the DANE tabulations disregarded on average about 21 days of exposure to the risk of childbearing.

Because the original survey data were available, it was also possible to use nonstandard five-year age groups to explore the effects that age heaping may have on the fertility estimates (Hill et al. 1982; United Nations, 1982). Table 75 shows the results of applying the P/F ratio method both to data classified according to the usual five-year age groups and to those classified according to nonstandard age groups. Note that the differences in observed parity between the standard and the nonstandard age groups display the expected pattern except for the oldest age group. The mean parity of the

TABLE 74 Comparison of Age-Specific Fertility Rates Derived from the 1978 NHS: Colombia

Age Group	Fertility Rates for June 1977 to May 1978[a]	Fertility Rates for Year Preceding Interview
15-19	.048	.052
20-24	.176	.181
25-29	.187	.200
30-34	.149	.159
35-39	.100	.107
40-44	.063	.064
45-49	.015	.015
Total Fertility Rate	3.690	3.892

[a]Source: DANE (1980).

TABLE 75 Application of the P/F Ratio Method to NHS Data on all Births, Using Standard and Nonstandard Age Groups: Colombia

Age Group	Observed Parity P(i)	Observed Fertility f(i)	Estimated Parity F(i)	P(i)/F(i)
Standard				
15-19	0.117	.052	0.108	1.08
20-24	0.953	.181	0.774	1.23
25-29	2.157	.200	1.775	1.22
30-34	3.590	.159	2.665	1.35
35-39	4.796	.107	3.294	1.46
40-44	6.148	.064	3.708	1.65
45-49	6.690	.015	3.875	1.73
Nonstandard				
13-17	0.040	.014	--	--
18-22	0.531	.140	0.436	1.22
23-27	1.663	.205	1.393	1.19
28-32	2.993	.167	2.301	1.30
33-37	4.479	.144	3.085	1.45
38-42	5.359	.077	3.585	1.49
43-47	6.768	.031	3.845	1.76

43-47 age group is slightly higher than that of the 45-49 age group, suggesting that the latter may be somewhat understated. The P/F ratios associated with both age classifications are fairly similar, and those for the younger age groups are much higher than the corresponding ones derived from either the 1973 census or the 1976 CFS (see Tables 67 and 69). For the 20-24 age group, the difference between the P/F ratios in the latter sources and that calculated from NHS data is approximately 0.10, a difference that cannot be accounted for entirely by fertility change. Reference-period errors are probably contributing to this difference.

Table 76 shows the results of applying the first-birth P/F ratio method to the NHS data. First, although neither age grouping set produces ratios with clearly increasing or decreasing trends, those associated with the usual five-year age groups increase steadily after 25-29. The use of nonstandard age groups reveals that this trend is not genuine, since it does not persist when the age groups are modified. Once the value for 15-19 is disregarded, the internal consistency of both P_1/F_1 sets is relatively high. The mean of the last six P_1/F_1

TABLE 76 Application of the P/F Ratio Method to NHS Data on First Births, Using Standard and Nonstandard Age Groups: Colombia

Age Group	Observed Proportions of Mothers $P_1(i)$	Observed First-Birth Fertility $f_1(i)$	Estimated Proportions of Mothers $F_1(i)$	$P_1(i)/F_1(i)$
Standard				
15-19	.088	.034	.076	1.16
20-24	.471	.061	.359	1.31
25-29	.740	.033	.588	1.26
30-34	.845	.006	.662	1.28
35-39	.891	.003	.681	1.31
40-44	.907	.001	.687	1.32
45-49	.911	.000	.687	1.33
Nonstandard				
13-17	.035	.010	--	--
18-22	.309	.064	.238	1.30
23-27	.663	.042	.509	1.30
28-32	.806	.018	.643	1.25
33-37	.889	.005	.686	1.29
38-42	.886	.002	.699	1.27
43-47	.923	.000	.701	1.32

values of each set is 1.30 for the standard age groups and 1.29 for the nonstandard. These mean values are very high, especially when compared with those obtained from 1973 census or the 1976 CFS (1.11 and 1.01, respectively). Notice also that according to the NHS current first-birth fertility rates, only about 70 percent of all women would ever become mothers. This figure is clearly too low. The equivalent figure according to the 1973 census is 80 percent, while according to the 1976 CFS it is 91 percent. Since it is unlikely that fertility changes alone could cause such erratic changes in the projected proportions of mothers, one can only conclude that both the 1973 census and the 1978 NHS current fertility data are deficient.

In the case of the NHS it is almost certain that the 1.2 adjustment factor suggested by the P/F ratio method based on all births is too high; it would yield a total fertility estimate of approximately 4.67. Hence, the adjustment factor suggested by the first-birth data, being about 0.10 greater, is certainly excessive for all births. However, if it is applied only to first births,

a lower bound for fertility in 1977-78 can be obtained. This bound is equal to a total fertility of approximately 4.10; however, because it is produced by a combination of adjusted first births and observed births of other orders, it is associated with a fertility schedule that is likely to be too high at younger ages. For this reason, the fertility schedule itself is not presented.

3.2.5 The 1978 Contraceptive Prevalence Survey

Table 77 shows the fertility estimates obtained from the information on parity and date of most recent birth recorded by the 1978 CPS, which was conducted with individual interviews. The estimated P/F ratio for 15-19 is too high, probably because the rounded figure for P(1) is not close enough to the observed (see note in Table 77). At ages 20-24 and 25-29, the ratios are similar to those obtained from the 1973 census sample and from the 1976 CFS, but for older ages their values are higher than those estimated from the other sources. At ages 30 and over the 1978 CPS P/F ratios are similar to those implied by the 1978 NHS data. Differences between these two sources are evident mainly at younger ages.

Since the 1978 CPS was conducted only six months after the 1978 NHS, one would expect close correspondence between the estimates yielded by the two surveys. The total fertility estimates agree fairly well, the CPS

TABLE 77 Application of the P/F Ratio Method to Data from the 1978 Contraceptive Prevalence Survey: Colombia

Age Group	Observed Parity[a] P(i)	Observed Fertility f(i)	Estimated Parity F(i)	P(i)/F(i)
15-19	0.20	.059	0.119	1.68
20-24	1.00	.207	0.903	1.11
25-29	2.30	.186	1.903	1.21
30-34	3.80	.142	2.700	1.41
35-39	5.20	.107	3.314	1.57
40-44	6.00	.045	3.651	1.64
45-49	7.50	.011	3.772	2.00

[a]Available tabulations showed data rounded to the first decimal place.

Source: CCRP (1979:38, 44).

estimate (3.785) being only slightly lower than the NHS estimate (3.892). However, a comparison of the average parities recorded by each survey shows that the CPS values are almost always higher. (Unfortunately, the rounding reflected in the CPS data introduces some uncertainties in this respect.) If, as Hobcraft's analysis of the CFS suggests, women who are selected and respond to individual interviews are more likely to have higher fertility than all women as a group, then the results presented in Table 77 are to be expected. The same phenomenon may account for the slightly higher current fertility rates observed among young women in the CPS in comparison with those recorded by the NHS.

At first sight, the overall similarity of the fertility estimates yielded by the CPS and the NHS appears to be reassuring. However, because of the deficiencies that a detailed analysis of the NHS data uncovered, congruence between its results and those of the CPS casts doubts on the accuracy of the latter. Unfortunately, in the case of the CPS, further consistency checks are not possible because the basic tabulations are lacking. Availability of the raw data on children ever born, the number of women interviewed, women of zero parity, and the number of first births occurring during the year immediately preceding the interview would be very helpful.

3.2.6 Intersurvey Estimates

Because a pair of demographic enquiries conducted during the 1970s is spaced approximately five years apart, intersurvey estimates of fertility can be calculated via the hypothetical cohort approach. This pair is the 1973 census and the 1978 NHS. (In theory the 1973 census and the 1978 CPS would constitute a second pair. Unfortunately, the unavailability of the raw CPS data precludes its use for intersurvey comparisons since parities rounded to only one decimal place are too crude an input for the type of analysis required.)

Two methods may be used in estimating intersurvey fertility (Zlotnik and Hill, 1981). The first is based exclusively on the parity increments observed from one point in time to the next. These parity increments allow the estimation of average parities for a hypothetical cohort subject to intersurvey fertility. The estimated mean parities can then be transformed to cumulated fertility, thus yielding estimates comparable to those

obtained by other means. The second approach is a variation of the usual P/F ratio method, where the estimated mean parities for a hypothetical cohort subject to the intersurvey fertility experience are compared with a mean observed fertility schedule representing this experience.

The results of applying the first method are presented in Table 78. The observed parity increments are presented in the column labeled Δi. The estimated intersurvey values are labeled "synthetic" because they refer to a hypothetical or synthetic cohort. The values of F(i,s) can be interpreted as intersurvey estimates of cumulated fertility. (The letter s is used to indicate "synthetic.") Therefore, the value of F(7,s) is an estimate of intersurvey total fertility. This value, 5.95, is clearly too high; it is even greater than the total fertility values that would be obtained by adjusting the 1973 and 1978 NHS current fertility estimates by the P/F ratios associated with age group 20-24, that is, 5.13 and 4.79, respectively. The immediate cause of this inconsistent outcome is that the observed parity increments are too large, mainly because some of the parities recorded by the 1973 census are too low. This is especially noticeable in the 1973 parities for age groups 40-44 and 45-49 compared with those recorded in 1978. The latter are greater, which would not be expected unless fertility were on the rise. The possibility that parities at younger ages in 1973 might also be somewhat understated cannot be discarded, although it is less obvious. How-

TABLE 78 Estimation of Intersurvey Fertility on the Basis of Parity Increments, 1973-78: Colombia

Age Group	i	1973 Census P(i,1)	1978 NHS P(i,2)	Δi	Synthetic Values P(i,s)	Synthetic Values F(i,s)
15-19	1	0.1435	0.1166	(0.1166)	0.1166	0.4105
20-24	2	1.0503	0.9527	0.8092	0.9258	1.4629
25-29	3	2.4400	2.1566	1.1063	2.0291	2.6180
30-34	4	3.9349	3.5898	1.1498	3.1789	3.6410
35-39	5	5.1069	4.7957	0.8608	4.0397	4.5335
40-44	6	5.8659	6.1483	1.0414	5.0811	5.5665
45-49	7	6.1075	6.6897	0.8238	5.9049	5.9462

Note: See text for definition of Δi and "synthetic values."

ever, even the value of F(5,s) is already too high to be consistent with any reasonable estimate of fertility cumulated up to age 40 for the 1973-78 period. Hence, it is likely that even the mean parities at younger ages were underreported in 1973. This conclusion would be consistent with the fact that the child mortality estimates derived from census data were shown to be, in general, too low.

Table 79 shows the results obtained by applying the second method of intersurvey fertility estimation to the 1973-78 data. Notice that the equivalent of the P/F ratios, here denoted as P/π, increase with age, which would not be expected if the estimated synthetic parities really represented the intersurvey experience. However, such a behavior is consistent with the existence of underreporting of children ever born in 1973, since such a flaw in the basic data would lead to estimates of mean intersurvey parities whose positive biases increase with age.

Notice also that at ages 20-24 and 25-29 the P/π ratios are fairly similar. Therefore, just as in any application of the P/F ratio method in cases where fertility has remained constant, the values of P/π for those age groups may be used as adjustment factors for the observed mean intersurvey fertility schedule. The ratio associated with the 20-24 age group was used to adjust the observed f(i,s) values.

A second adjustment was necessary to obtain an intersurvey fertility schedule referring to the usual five-year age groups, since the one presented in Table 79 is based on a female population whose true age at the time of the births occurring during the year preceding the survey was, on average, half a year younger than that reported at the

TABLE 79 Estimation of Intersurvey Fertility Using a P/F Ratio Method for Synthetic Cohorts, 1973-78: Colombia

Age Group	i	1973 Census f(i,1)	1978 NHS f(i,2)	Synthetic Values f(i,s)	π(i,s)	P(i,s)	P/π
15-19	1	.0652	.0523	.0588	0.1224	0.1166	0.95
20-24	2	.2063	.1809	.1936	0.8491	0.9258	1.09
25-29	3	.2127	.1999	.2063	1.8892	2.0291	1.07
30-34	4	.1824	.1594	.1709	2.8244	3.1789	1.13
35-39	5	.1395	.1074	.1235	3.5339	4.0397	1.14
40-44	6	.0703	.0637	.0670	3.9755	5.0811	1.28
45-49	7	.0240	.0149	.0195	4.1754	5.9049	1.41

time of interview. The fully adjusted intersurvey fertility schedule, displayed in Table 80, shows that total fertility amounted to 4.58. Such a value implies that the total fertility estimates derived directly from the 1973 and 1978 NHS data are somewhat low (4.50 and 3.89, respectively). However, as we shall see later, the adjustments necessary to make these figures consistent with the adjusted intersurvey level are well in line with those that might be inferred from detailed analysis of each data set.

3.2.7 Summary of the P/F Ratio Estimates

The preceding sections have presented the results of applying several variants of the P/F ratio method to the available data. In all cases, except the 1969 NFS, the method confirmed the existence of a fertility decline when it was applied to data on all births. Applications made to first-birth data showed that the CFS had a high level of internal consistency, while the 1973 census and the 1978 NHS data are somewhat deficient. The same is probably true about the 1978 CPS, but lack of appropriate tabulations limited the possibilities of further assessment.

TABLE 80 Adjusted Intersurvey Fertility Schedule, 1973-78: Colombia

Age Group	Adjusted[a] f(i)
15-19	.079
20-24	.220
25-29	.223
30-34	.181
35-39	.130
40-44	.067
45-49	.017
Total Fertility Rate	4.577

[a]Adjustment factor = 1.09.

For future reference, Table 81 presents the age-specific fertility schedules produced by each of the sources analyzed in this section, all adjusted for the half-year age shift implicit in data referring to the year preceding a survey.

3.3 DATA ON OWN CHILDREN

The data on age and relationship to head of the household gathered by almost any household survey or census can be used to estimate fertility. Cho (1973) has suggested a technique that allows age-specific fertility rates to be estimated from data on enumerated children classified by single years of their own age and by single years of their mother's age. If these data are available, reverse projection of the female population to each of the 10 or 15 years preceding the survey and of the enumerated children (persons under 15) to the time of their birth makes it possible to calculate period age-specific fertility rates. In addition to the usual "own children" tabulation (children classified according to the ages of their mothers), this procedure requires as input detailed estimates of mortality for children and for adult females.

For Colombia, the appropriate estimates of mortality are available (see Chapter 2). Furthermore, adequate own-children tabulations have been produced for each of the potential sources: the 1973 census sample, the household data from the 1976 CFS, and the 1978 NHS. In the first case, the tabulation required was obtained by

TABLE 81 Current Fertility Schedules Based on Data on Births Last Year Adjusted for a Half-Year Age Displacement, Five Sources: Colombia

Age Group	1969 NFS f(i)	1973 Census f(i)	1976 CFS Household f(i)	1978 NHS f(i)	1978 CPS f(i)
15-19	.118	.080	.088	.064	.074
20-24	.280	.214	.219	.189	.213
25-29	.305	.211	.201	.198	.182
30-34	.272	.179	.171	.154	.138
35-39	.240	.134	.128	.104	.102
40-44	.114	.064	.052	.058	.040
45-49	.019	.019	.016	.011	.008
Total Fertility Rate	6.740	4.503	4.370	3.892	3.785

matching the enumerated children to their mothers on the basis of certain criteria (age, relationship to the head of the household, etc.). For the 1976 and 1978 data, however, no artificial matching was necessary because the surveys included either a coding mechanism or a question identifying the mother of each recorded child whenever she lived in the same household as the child.

Estimates obtained by applying the own-children method to the three data sources are presented in Tables 82, 83, and 84. Every set shows a fairly consistent trend of declining total fertility rates. Notice that in the CFS set (Table 83) the estimate for the 45-49 age group is not always derived directly from the data. This age group was left out in some cases because the available data on own-children were tabulated only for mother's ages ranging from 10 to 60; therefore, at earlier periods truncation was necessary. To make the estimated series comparable, fertility rates for age groups 45-49 were imputed on the basis of the rates for the five-year period immediately preceding them.

In general, each series is remarkably well behaved. Very few values are out of line with the contiguous ones, indicating that age heaping under age 15 is not severe. There are, however, some preferred ages that tend to attract respondents more than others, as Table 85 illustrates. For example, age 12 seems to be even more attractive than ages 10 or 15. Therefore, own-children estimates corresponding to a period 12 to 13 years before each survey will be too high and should be disregarded.

Unfortunately, age heaping is not the only potential source of spurious fluctuations in the fertility estimates derived from own-children information. Selective underenumeration of young children can also seriously bias the estimates for recent periods. This phenomenon is clearly operating in the 1973 census sample, in which the recorded number of children under age 1 is obviously too low (it implies a total fertility rate for 1972-73 of only 2.54 children per woman). Although the other two data sources are not so obviously flawed by the underenumeration of young children, the fertility estimates they imply for recent periods cannot be accepted without further validation.

For the moment, we conclude by noting the three-year averages presented in Part B of Tables 82, 83, and 84. Although smoother than the series of annual fertility estimates, the three-year period estimates are not entirely free from the problems associated with heaping

TABLE 82 Estimates of Fertility Derived from the 1973 Census Sample by the Own-Children Method: Colombia

	Estimated Fertility Rates by Five-Year Age Groups							
Age	1972-73	1971-72	1970-71	1969-70	1968-69	1967-68	1966-67	1965-66
15-19	0.0351	0.0654	0.0804	0.0924	0.0965	0.1068	0.1164	0.1295
20-24	0.1106	0.1813	0.2116	0.2421	0.2552	0.2568	0.2666	0.2851
25-29	0.1210	0.1925	0.2281	0.2584	0.2769	0.2878	0.2950	0.3236
30-34	0.1084	0.1647	0.2060	0.2312	0.2378	0.2516	0.2485	0.2645
35-39	0.0791	0.1180	0.1355	0.1624	0.1675	0.1820	0.1848	0.2005
40-44	0.0411	0.0635	0.0737	0.0845	0.0909	0.0893	0.0884	0.0887
45-49	0.0126	0.0191	0.0209	0.0214	0.0217	0.0184	0.0233	0.0229
TFR	2.5391	4.0222	4.7808	5.4623	5.7326	5.9629	6.1144	6.5740

Age	1964-65	1963-64	1962-63	1961-62	1960-61	1959-60	1958-59
15-19	0.1322	0.1316	0.1386	0.1430	0.1538	0.1587	0.1512
20-24	0.3015	0.3006	0.3124	0.3147	0.3264	0.3442	0.3069
25-29	0.3305	0.3240	0.3292	0.3253	0.3439	0.3412	0.3338
30-34	0.2833	0.2619	0.2948	0.2844	0.3074	0.3138	0.2873
35-39	0.2191	0.1930	0.2083	0.1967	0.1998	0.2021	0.1763
40-44	0.0917	0.0837	0.0862	0.0845	0.0999	0.0916	0.0906
45-49	0.0220	0.0200	0.0259	0.0211	0.0260	0.0251	0.0219
TFR	6.9007	6.5736	6.9768	6.8486	7.2859	7.3836	6.8400

	Estimated Fertility Rates for Three-Year Averages				
Age	1971-73	1968-70	1965-67	1962-64	1959-61
15-19	0.0603	0.0986	0.1260	0.1377	0.1546
20-24	0.1678	0.2514	0.2844	0.3092	0.3258
25-29	0.1806	0.2744	0.3164	0.3262	0.3397
30-34	0.1597	0.2402	0.2654	0.2804	0.3028
35-39	0.1109	0.1706	0.2015	0.1993	0.1927
40-44	0.0594	0.0882	0.0896	0.0848	0.0940
45-49	0.0175	0.0205	0.0227	0.0223	0.0243
TFR	3.7807	5.7193	6.5297	6.7996	7.1698

TABLE 83 Estimates of Fertility Derived from the 1976 CFS Household Schedule by the Own-Children Method: Colombia

	Estimated Fertility Rates by Five-Year Age Groups							
Age	1975-76	1974-75	1973-74	1972-73	1971-72	1970-71	1969-70	1968-69
10-14	0.0008	0.0015	0.0018	0.0032	0.0024	0.0040	0.0048	0.0049
15-19	0.0906	0.0926	0.0852	0.1092	0.0977	0.1224	0.1238	0.1192
20-24	0.1979	0.2020	0.2141	0.2285	0.2419	0.2851	0.2796	0.2805
25-29	0.1913	0.1885	0.1853	0.2091	0.2736	0.2697	0.2896	0.3114
30-34	0.1693	0.1669	0.1613	0.1815	0.1894	0.2267	0.2470	0.2456
35-39	0.1163	0.1161	0.0915	0.1243	0.1335	0.1679	0.1909	0.1822
40-44	0.0343	0.0518	0.0615	0.0735	0.0752	0.0831	0.1013	0.0827
45-49	0.0193	0.0159	0.0062	0.0222	0.0159	0.0293	0.0133	0.0137
TFR	4.0988	4.1766	4.0344	4.7578	5.1479	5.9409	6.2520	6.2005

Age	1967-68	1966-67	1965-66	1964-65	1963-64	1962-63	1961-62
10-14	0.0073	0.0075	0.0108	0.0150	0.0148	0.0120	0.0116
15-19	0.1229	0.1256	0.1339	0.1420	0.1573	0.1739	0.1579
20-24	0.2971	0.3059	0.3083	0.2920	0.3455	0.3298	0.3323
25-29	0.3440	0.2934	0.3292	0.2888	0.3432	0.3584	0.3813
30-34	0.2649	0.2317	0.3086	0.2720	0.3013	0.3232	0.3107
35-39	0.2050	0.1719	0.2192	0.1951	0.2233	0.2499	0.1963
40-44	0.0905	0.0735	0.0843	0.0766	0.1002	0.1042	0.0863
45-49	0.0254	0.0077	(0.0202)	(0.0186)	(0.0215)	(0.0225)	(0.0214)
TFR	6.7861	6.0861	7.0729	6.5008	7.5357	7.8692	7.4891

	Estimated Fertility Rates for Three-Year Averages				
Age	1974-76	1971-73	1968-70	1965-67	1962-64
10-14	0.0014	0.0032	0.0056	0.0111	0.0128
15-19	0.0894	0.1098	0.1220	0.1339	0.1630
20-24	0.2046	0.2519	0.2857	0.3021	0.3359
25-29	0.1884	0.2508	0.3150	0.3038	0.3610
30-34	0.1658	0.1992	0.2525	0.2708	0.3117
35-39	0.1080	0.1419	0.1927	0.1954	0.2232
40-44	0.0492	0.0773	0.0915	0.0781	0.0969
45-49	0.0138	0.0225	0.0175	(0.0225)	(0.0262)
TFR	4.1033	5.2822	6.4128	6.5881	7.6532

( ): Imputed values

TABLE 84 Estimates of Fertility Derived from the 1978 NHS by the Own-Children Method: Colombia

	Estimated Fertility Rates by Five-Year Age Groups							
Age	1977-78	1976-77	1975-76	1974-75	1973-74	1972-73	1971-72	1970-71
15-19	0.0659	0.0744	0.0765	0.0968	0.0978	0.0972	0.1092	0.1217
20-24	0.1779	0.1813	0.2022	0.2147	0.2273	0.2345	0.2416	0.2837
25-29	0.1764	0.1849	0.1963	0.1829	0.2213	0.2284	0.2296	0.2716
30-34	0.1516	0.1419	0.1679	0.1728	0.1911	0.1707	0.1942	0.2340
35-39	0.0985	0.0873	0.1266	0.1147	0.1257	0.1238	0.1544	0.1543
40-44	0.0432	0.0295	0.0379	0.0609	0.0579	0.0718	0.0736	0.0864
45-49	0.0131	0.0090	0.0105	0.0105	0.0142	0.0166	0.0218	0.0139
TFR	3.6328	3.5410	4.0898	4.2671	4.6769	4.7147	5.1221	5.8276

Age	1969-70	1968-69	1967-68	1966-67	1965-66	1964-65	1963-64
15-19	0.1120	0.1156	0.1048	0.1333	0.1381	0.1543	0.1517
20-24	0.2737	0.2957	0.2851	0.2805	0.3055	0.2935	0.3313
25-29	0.2916	0.2558	0.2990	0.2816	0.3206	0.3126	0.3287
30-34	0.2321	0.2295	0.2644	0.2356	0.3033	0.2843	0.2543
35-39	0.2019	0.1749	0.1699	0.1690	0.2438	0.2205	0.2026
40-44	0.0863	0.0745	0.0694	0.0905	0.0811	0.0852	0.0888
45-49	0.0132	0.0270	0.0222	0.0204	0.0164	0.0242	0.0201
TFR	6.0544	5.8650	6.0744	6.0542	7.0440	6.8727	6.8871

	Estimated Fertility Rates for Three-Year Averages				
Age	1976-78	1973-75	1970-72	1967-69	1964-66
15-19	0.0723	0.0973	0.1143	0.1179	0.1481
20-24	0.1871	0.2255	0.2663	0.2871	0.3101
25-29	0.1859	0.2109	0.2642	0.2788	0.3206
30-34	0.1538	0.1782	0.2201	0.2431	0.2806
35-39	0.1041	0.1214	0.1702	0.1713	0.2223
40-44	0.0369	0.0635	0.0821	0.0781	0.0850
45-49	0.0109	0.0138	0.0163	0.0232	0.0202
TFR	3.7545	4.5529	5.6680	5.9978	6.9346

TABLE 85 Population Under Age 16 Classified by Single Years of Age, Selected Sources (in thousands): Colombia

Age	1973 Census Sample	1976 CFS	1978 NHS
0	466	181	670
1	503	173	616
2	587	158	641
3	615	175	661
4	609	174	677
5	616	196	668
6	608	189	701
7	644	186	761
8	631	188	740
9	568	172	701
10	631	189	715
11	542	157	680
12	617	194	802
13	561	178	700
14	510	171	722
15	505	153	699

and underenumeration. Hence, estimates incorporating the data on children aged 12 at the time of interview or those incorporating the data on children under age 1 are still likely to over- or underestimate fertility, respectively.

3.4 SUMMARY EVALUATION OF THE EVIDENCE

Preceding sections have presented sets of fertility estimates derived from different sources and by a variety of means. To extract from them a series of consistent and plausible fertility estimates for the 1964-78 period, we begin by comparing the total fertility estimates obtained on the basis of the CFS maternity histories with those derived via the own-children method applied to the 1973 census sample, the household data of the 1976 CFS, and the 1978 NHS. Figures 12, 13, and 14 display these different pairs of estimates. As Figure 12 indicates, the fertility estimates obtained from data on children

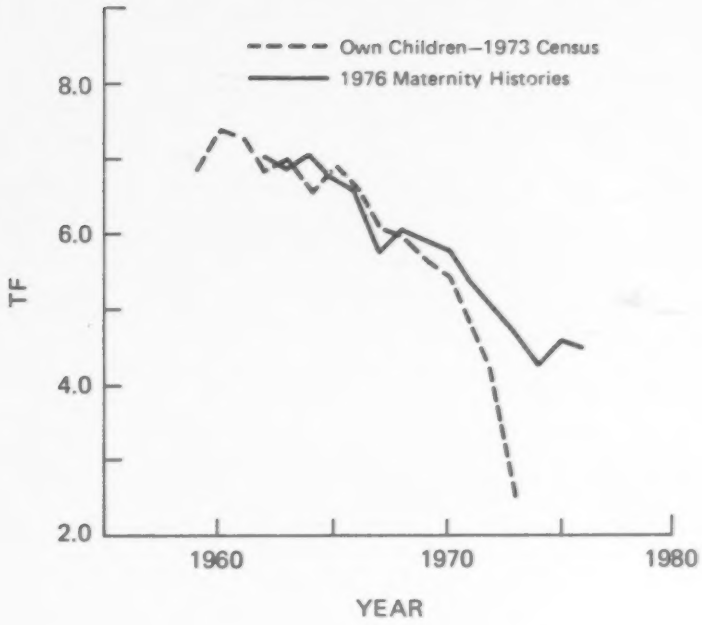


FIGURE 12 Comparison of Fertility Estimates Derived from the 1973 Census via the Own-Children Method and Those Obtained from the 1976 CFS Maternity Histories: Colombia

aged 2 or less in 1973 are too low. However, the overall consistency between the maternity history estimates and the ones obtained from the census for the 1962-68 period is reassuring, and although the census figures are affected by some age heaping--especially at ages 8, 10, 12, and 13--its impact is fairly mild.

Figure 13 compares the estimates obtained from 1976 CFS maternity histories with those obtained from the CFS own-children data. The comparison shows that the age distribution of children enumerated by the CFS is subject to a higher degree of distortion due to age heaping than that produced by the census. Furthermore, the own-children CFS estimates are higher on the whole than those implied by either the census or the maternity history estimates. However, especially for the earlier periods (1961-64), it is clear that the CFS own-children estimates are too high because they are derived from attractive age groups. The possibility that the same type of problem may produce the relatively high own-children estimates for the 1967-71 period should be kept in mind. In

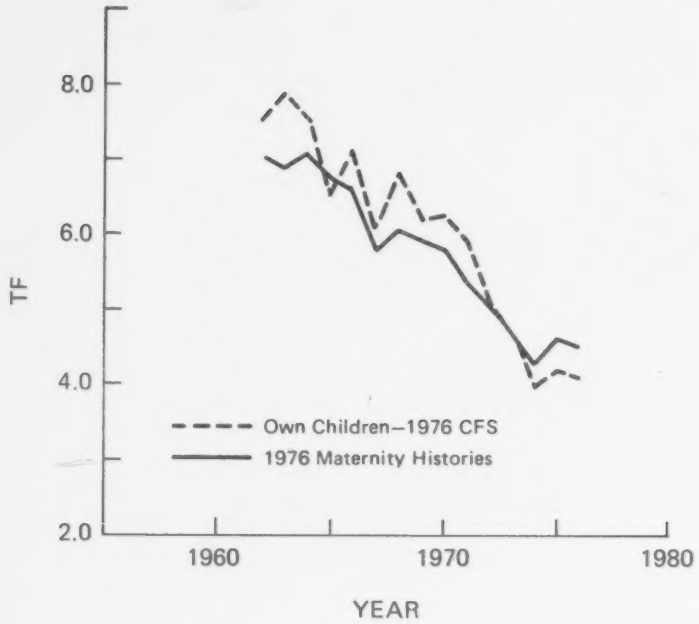


FIGURE 13 Comparison of Fertility Estimates Derived from the 1976 CFS via the Own-Children Method and Those Obtained from the 1976 CFS Maternity Histories: Colombia

addition, it must be pointed out that the total fertility estimates derived from the own-children CFS data include a fertility rate for the 10-14 age group. Although the contribution of this age group is fairly small, it certainly increases the estimated TF values.

Figure 13 also shows that maternity history data are not entirely exempt from the effects of age heaping. Notice that several of the troughs and peaks evident in the own-children estimates are also present in the ones derived from maternity history data. However, the effect of heaping is smaller on the latter.

Figure 14 compares the estimates implied by CFS maternity history data and those derived from the own-children data of the 1978 NHS. Once more, the general agreement between these two sets of estimates is high and reassuring. For most of the period covered jointly, the maternity history estimates lie below those implied by the NHS, but at some ages this outcome is clearly due to the distorting effect of age heaping. For the most recent period (1975-78) the NHS estimates are probably too low,

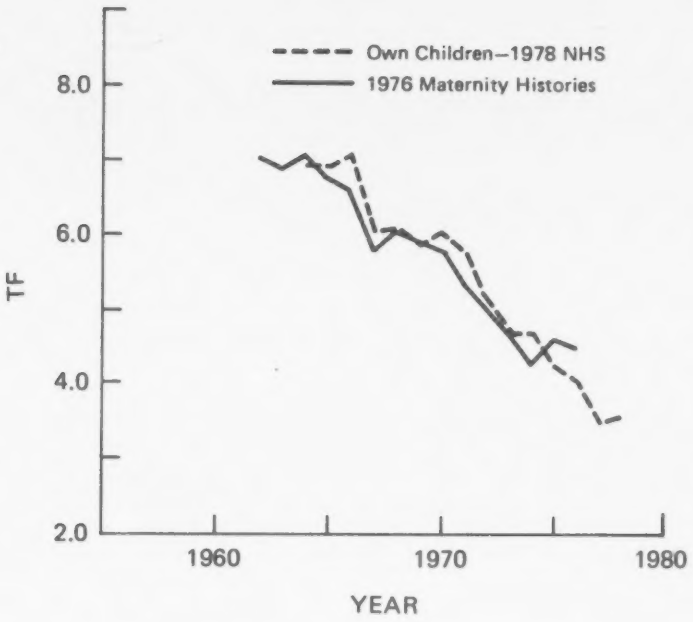


FIGURE 14 Comparison of Fertility Estimates Derived from the 1978 NHS via the Own-Children Method and Those Obtained from the 1976 CFS Maternity Histories: Colombia

although they conform fairly well to the declining trend implicit in the sets displayed.

Figure 15 displays the major estimates presented so far. With few exceptions, the various sources agree very well. Perhaps the most prominent exceptions are the 1970-73 estimates derived from the 1973 census, which are evidently too low, and the NFS estimate for 1969 (Ochoa and Ordonez, 1980), which is clearly too high, approximating closely the estimate derived from children aged 8 (an attractive age) at the time of the CFS.

The case of the 1969 NFS requires further discussion. Recall that when the P/F ratio test was applied to the data (Ochoa-Ordonez version), the estimates obtained appeared to be internally consistent. However, the fertility level they imply for 1968-69 is considerably higher than the levels estimated for previous periods on the basis of the same data (Elkins in ASCOFAME, 1973a). Moreover, there is other internal evidence suggesting that the NFS probably underestimates fertility prior to 1969. However, according to Figure 15, Elkins' estimates

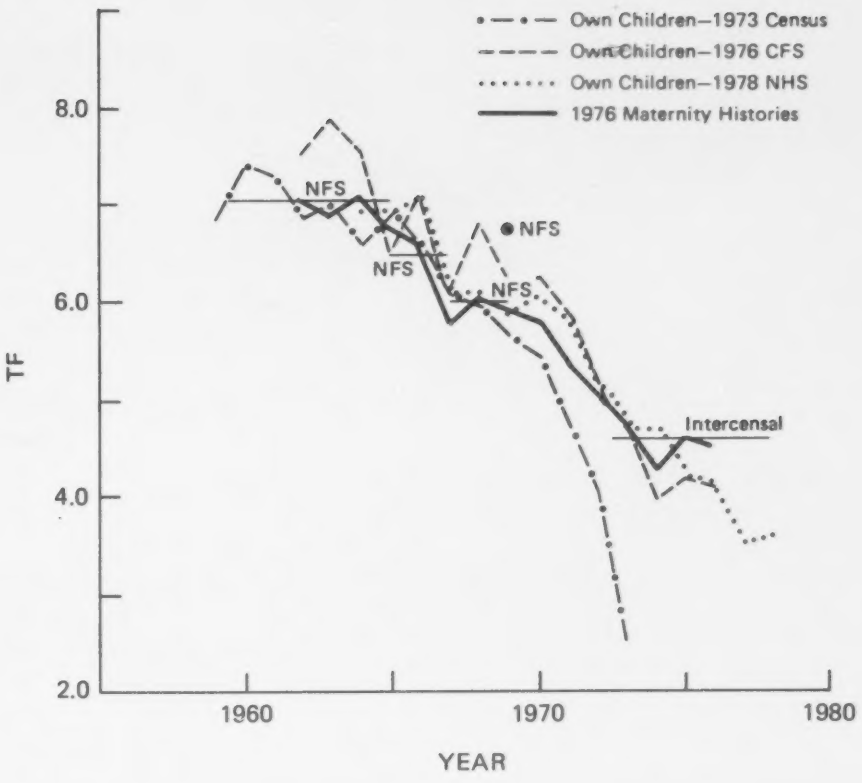


FIGURE 15 Comparison of Fertility Estimates Derived from Several Sources: Colombia

(shown as solid, horizontal lines labeled "NFS") are in good agreement with those derived from other sources, while the single-point estimate proposed by Ochoa and Ordonez is clearly out of line with all the rest. Hence, we can either conclude that most sources underestimate fertility or that the NFS is subject to some type of positive bias that balances the negative ones detected in its data. We believe that the latter is the most plausible explanation, especially because the NFS sample is not truly representative of the country as a whole (see Appendix B). An overrepresentation of the rural population in the NFS data could very well account for the results obtained. In view of these observations, the NFS estimates are omitted from the following evaluation.

Another aspect of Figure 15 that deserves comment is the relationship between the 1973-78 intersurvey or

intercensal estimate and those obtained from other sources. Notice first that the intercensal estimate agrees closely with those obtained from the CFS maternity-history data, especially if one treats it as a mid-period estimate referring roughly to 1975-76. Second, its level implies that the own-children estimates derived from children aged 0-2 in 1976 and 0-3 in 1978 are too low, a fact that is not surprising given the typical problems affecting own-children estimates. In conclusion, therefore, the intersurvey estimate is not inconsistent with those obtained from other sources and although it may not be perfectly correct, it is probably the best possible estimate for the 1975-76 period.

3.5 DERIVING A YEARLY SERIES OF TOTAL FERTILITY ESTIMATES, 1964-78

Up to this point no consideration has been given to estimates obtained from data on births during the year preceding each survey (with the exception of the discredited NFS estimates). It is possible to compare single-year estimates based on births last year to own-children and maternity history estimates. However, because the former are affected by age heaping and other types of biases, such comparisons tend not to be very enlightening. Therefore, it is usually best to smooth such estimates before comparing them with others. Figure 16 displays the trend curves obtained by plotting the three year averages of the own-children estimates (from Tables 82, 83, and 84).

Although smoother than the single-year estimates, the curves in Figure 16 are not necessarily unbiased, because deficiencies in the single-year data may still affect some of their points. For example, those corresponding to the three-year period immediately preceding each survey are likely to be too low, while those corresponding to the furthest period before each survey (obtained from children aged 12-14) are likely to be too high. The solid line in Figure 16 is an estimated trend line that approximates fairly well the most reliable points of each set. The trend line was obtained by assuming that the total fertility rate in 1963 was about 7.0 and that the estimated intercensal total fertility (4.6) corresponded approximately to 1976. This line implies that total fertility in 1964 was approximately 6.8 children per woman. Such a total fertility rate, coupled with a model

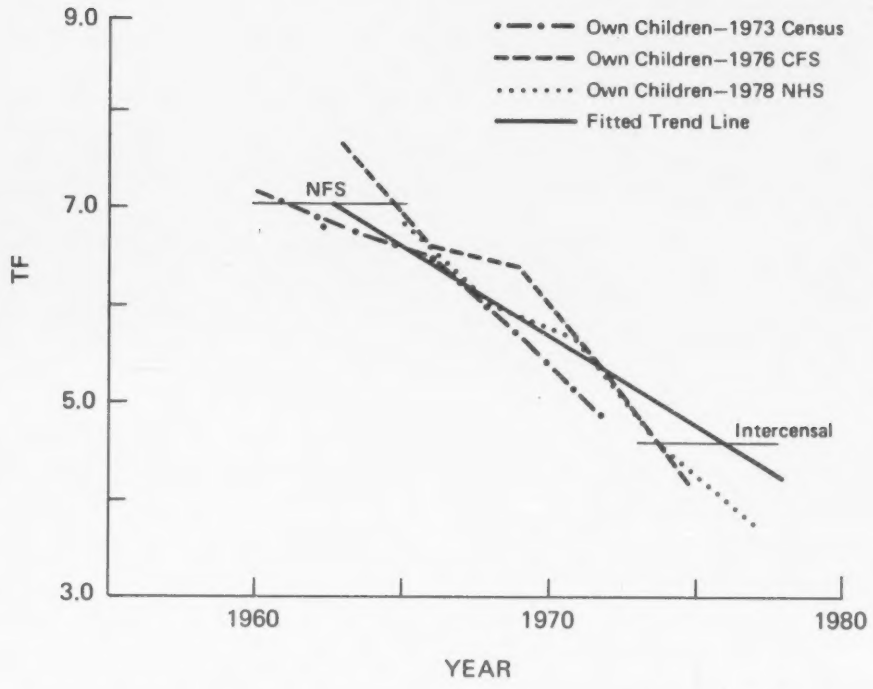


FIGURE 16 Fitted Fertility Trend Line, 1963-78, and Smoothed Fertility Estimates Derived from Own-Children Estimates: Colombia

fertility schedule fitted to the one obtained from the CFS own-children data for 1963-64 and applied to the age distribution derived via the stable and quasi-stable populations fitted in Chapter 2 to the 1951 and 1964 populations (Set 2), produces estimates of birth rates by sex that are very similar to those implied by the quasi-stable fit: the quasi-stable birth rate estimates for 1964 (Table 42) are .0476 for males and .0462 for females, while those obtained from the fitted fertility schedule in Figure 17 are .0481 and .0467, respectively (assuming that the sex ratio at birth is 1.034). Although exact coincidence is not achieved, the similarity of the two sets is reassuring. (A TF value of 6.73 in 1964 would assure coincidence, but the difference between this value and 6.8 is so small that it does not warrant selection of a different trend line.) For reference, the yearly TF estimates implied by the trend line in Figure 13 are presented in Table 3 (report summary).

3.5.1 Comparing the Yearly Series of Total Fertility Estimates (Fitted Trend Line) to Estimates Based on Births Last Year

The estimates in Table 3 can be compared with those obtained from data on the number of births during the year preceding each survey (Table 81). The limitations of the NFS estimates have already been discussed, so the first comparison to be made is with the 1973 census estimate of TF (4.50 children per woman). If the fitted-trend-line estimate in Table 3 is correct, total fertility in 1973 was 5.15, which means that the census underestimated fertility by about 14 percent. It is interesting to note that an adjustment of just that size is implied by the P/F ratio associated with age group 20-24 (see Table 67). In addition, an upward adjustment of about 12 percent is suggested by the P_1/F_1 ratios for age groups 20-24 to 40-44 in 1973 (see Table 68). The latter adjustment would produce a total fertility rate of 5.04 for 1973, a value that is very close to the 5.15 implied by the fitted trend line. It can be concluded, therefore, that the 1973 census data on births last year and children ever born do not invalidate the trend-line estimates.

The next case for comparison is the 1976 estimate obtained from the household section of the CFS. It implies a total fertility of approximately 4.4, compared to the trend-line estimate of 4.6. The trend-line estimate was derived from intersurvey comparisons, and although it is higher than the CFS household estimate and the one obtained from maternity histories (approximately 4.5), the difference is very small. Since there is no solid evidence indicating that one estimate is better than the others, we have preferred to be conservative and have chosen the highest of the three as the most acceptable. This choice is validated, in a way, by the fact that it implies a total fertility estimate of about 4.2 for 1978, while the minimum obtained in Section 3.2.4. for the same year is 4.1. Either of the lower estimates for 1976 would imply a TF value for 1978 closer to or even lower than the minimum, an outcome that does not seem satisfactory.

Probably the most uncertain estimates in Table 3 are those corresponding to the 1977-78 period, since they depend mainly on the extrapolation of those selected for previous periods and, as just noted, the one for 1978 is too close to the estimated minimum. However, in view of the available evidence, greater certainty is not possible for these most recent periods.

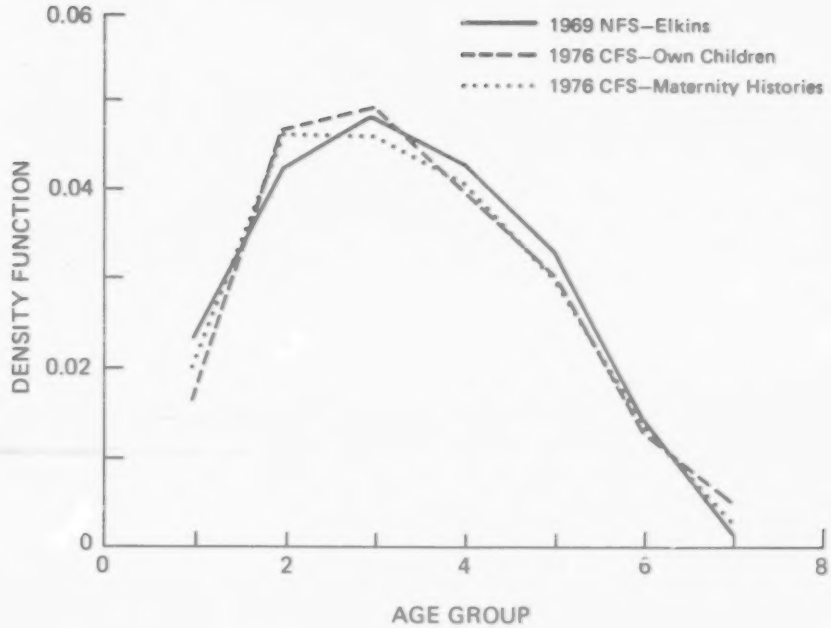
In conclusion, these comparisons indicate that the trend line estimates of Table 3 are reasonable and consistent with the bulk of the evidence. One cannot claim that they are exact, but they represent an acceptable compromise with respect to the overall levels observed during the period.

3.6 DERIVING A YEARLY SERIES OF AGE-SPECIFIC FERTILITY SCHEDULES, 1964-78

Given the available series of estimates of overall fertility, it would seem that a final series of age-specific fertility schedules could be derived directly from them. However, none of the available series of schedules is entirely exempt from the effects of errors. Maternity-history data are affected by errors in reporting the date of birth of each child and the age of the mother, and by truncation and censoring. Own-children data are also affected by age-reporting errors (for both children and adult females) and by matching errors. Matching errors arise when a child is erroneously assigned to a female member of the household who is not really his or her mother. Mismatches of this type often tend to assign fairly young children to relatively old mothers, artificially inflating the fertility rates at older ages.

3.6.1 Evaluation of the 1964 Estimates

To illustrate how these types of errors can affect the shape of the estimated fertility schedules, Figures 17, 18, and 19 compare fertility density functions derived from different sources for selected periods. (A fertility density function is an age-specific fertility schedule whose TF equals 1.) The first period considered is 1964 (Figure 17). The first panel of Figure 17 compares Elkins' 1969 NHS estimates with those derived from the CFS (own-children and maternity-history data). As expected, the consistency between the two sets of CFS estimates is high, although some important differences can be noticed. For example, while the mode of the own-children estimates is associated with the 25-29 age group, the modal point of the maternity-history schedule occurs at age group 20-24. It is also evident that the contribution of women aged 15-19 is higher in the maternity-history set than in the own-children set and



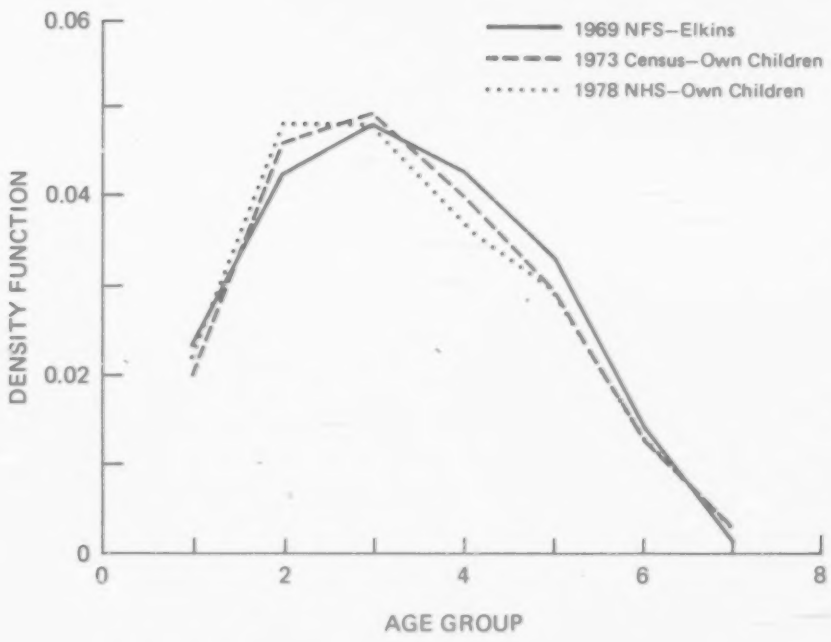
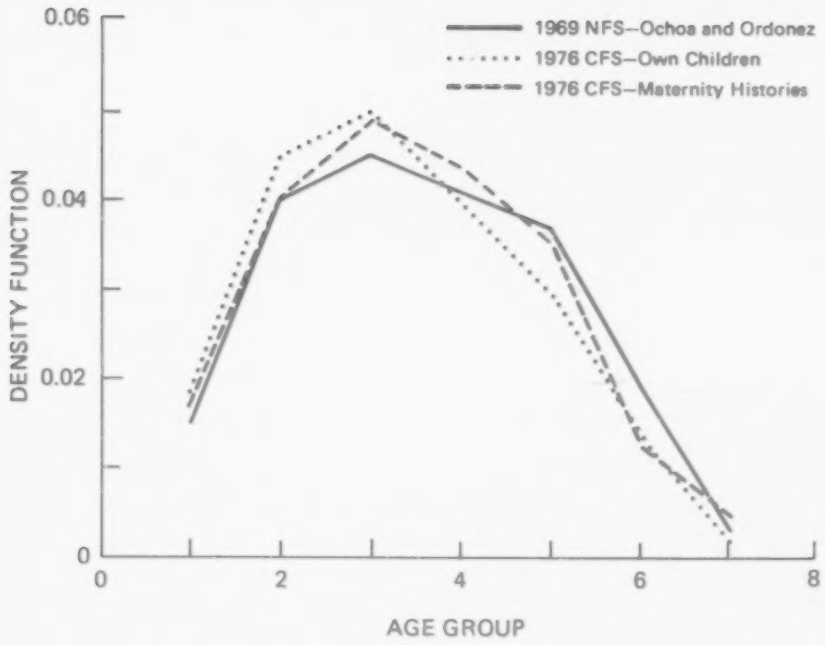


FIGURE 17 Comparison of Fertility Density Functions from Different Sources, 1964: Colombia



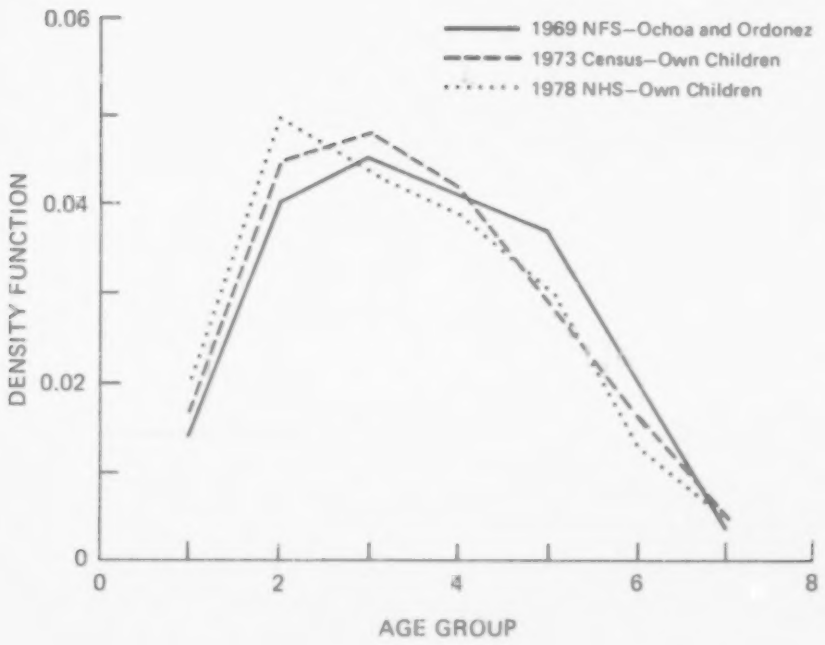
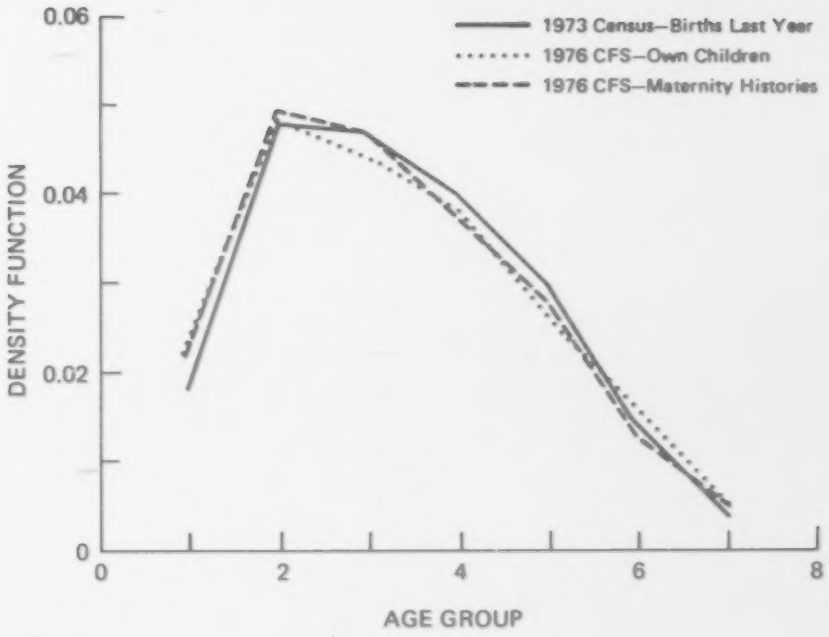


FIGURE 18 Comparison of Fertility Density Functions from Different Sources, 1969: Colombia



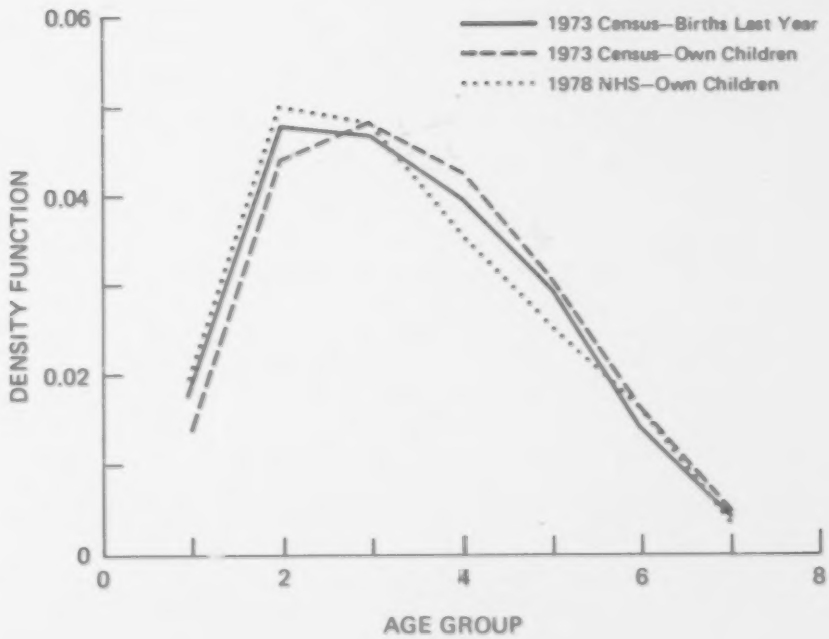


FIGURE 19 Comparison of Fertility Density Functions from Different Sources, 1973: Colombia

that women aged 45-49 have a greater impact in the own-children set than in the maternity-history set. These differences, although minor, may have nontrivial implications for the selection of a final set of consistent estimates, which is the reason for pointing them out at this stage.

Although not shown in Figure 17, the agreement between the 1973 and the 1976 own-children estimates is very good, especially over the 20-44 age range. The NHS estimates deviate more markedly from the general shape of the other two own-children sets, but the deviations are relatively small. Undoubtedly, the schedule whose shape is essentially different from all the others is the one derived from the NFS data. Being flatter and broader (i.e., having greater variance), it may be associated with a population that exercises less control over fertility and is probably subject to higher fertility levels. Once more, an overrepresentation of the rural population in the NFS sample is consistent with this outcome.

3.6.2 Evaluation of the 1969 Estimates

Figure 18 shows a similar set of comparisons for 1969. It is again evident that the NFS estimates deviate markedly from the shape of most of the others, but in 1969 the estimates derived from the CFS maternity histories agree somewhat better with the NFS estimates than with those derived from the CFS own-children, a fact that casts doubts on the accuracy of the maternity-history estimates. There is generally a good agreement between all the estimates derived from own-children data, even though the ones associated with the NHS display greater distortions than those obtained from either the census or the CFS.

The 1968-69 period helps illustrate the inconsistencies encountered in comparing fertility schedules derived from different sources. The maternity-history estimates for this period are inconsistent with those obtained for 1964 from the same source, assuming that a fertility decline usually implies greater reductions at older than at younger ages. If only the maternity-history data were available, one would have difficulties in reconciling the observed changes in the shape of the fertility schedules from 1964 to 1969 with the existence of a fertility decline. Fortunately, the availability of own-children estimates for the same period suggests that the distor-

tions observed in the maternity-history data are probably not real.

3.6.3 Evaluation of the 1973 Estimates

In contrast with 1969, the schedules presented in Figure 19 for the 1972-73 period are in excellent agreement. Although its shape is not altogether unsatisfactory, the most deviant one is that derived from the 1973 own-children data (it is the only one whose modal point occurs at age 25-29, for example).

3.6.4 Constructing a Smooth Series of Age-Specific Fertility Schedules, 1964-78

Using model fertility schedules to smooth and reduce some of the irregularities observed in direct estimates is common. At least two such models have been used frequently during recent years: the Coale-Trussell fertility models (Coale and Trussell, 1974) and the relational Gompertz model suggested by Brass (United Nations, 1982). Fitting the Coale-Trussell models requires knowledge not only of the observed age-specific fertility schedules but also of the proportions ever married by age. In the case of Colombia, estimates of the latter are very unreliable, hence it does not seem advisable to use the Coale-Trussell models, even though their versatility is high.

Having fewer parameters than the Coale-Trussell models, the relational Gompertz model is somewhat less flexible, but it has the advantage of not requiring any estimates of nuptiality. Therefore, it was used to fit several of the age-specific fertility schedules derived so far. Using the 1976 CFS own-children estimates for 1964 and an adjusted average of the NHS and CPS 1978 schedules (based on information on births occurring during the year preceding each survey) as basic indicators of the shape of the schedule at the beginning and the end of the period, a Gompertz relational model was fitted to each of them and linear interpolation on the Gompertz parameters was used to derive a consistent yearly series of fertility densities for the 1964-78 period. Trials with other beginning and ending shapes led to inconsistencies that did not seem acceptable. However, not every possibility was explored, so the one

selected, although basically satisfactory, represents simply an internally consistent representation of a plausible trend.

Once a smoothed yearly series of densities was obtained using the Gompertz model, it was coupled with the total fertility estimates presented in Table 3 to produce a series of yearly age-specific fertility schedules. A selected subset of these schedules is presented in Table 86, and three of them are displayed in Figure 3.

3.7 ESTIMATION OF A YEARLY SERIES OF BIRTH RATES, 1964-74

Comparison of the shapes of the fertility schedules displayed in Table 86 and those obtained from other sources show that the former are usually slightly higher at 15-19, lower above age 40, and that their agreement with the observed over the middle age range (20-39) is acceptable. However, notice that whereas the mode of all the fitted schedules occurs at 25-29, the observed ones are not always as consistent in this respect.

In conclusion, the estimates of Table 86 are internally consistent in the sense that they conform to a reasonable trend without being inconsistent with the available evidence. They do not reflect, however, what seem to be deviant cases, such as, for example, the 1969 maternity history schedule. Insofar as the latter are caused by errors rather than by true fluctuations in fertility, the Table 86 series should be preferred. However, because

TABLE 86 Fitted Age-Specific Fertility Schedules for Selected Years, 1965-78: Colombia

Age Group	1965	1968	1970	1973	1975	1978
15-19	.1415	.1291	.1209	.1087	.1006	.0886
20-24	.2998	.2788	.2644	.2422	.2270	.2036
25-29	.3126	.2896	.2740	.2501	.2338	.2089
30-34	.2665	.2444	.2297	.2074	.1926	.1703
35-39	.1971	.1781	.1657	.1474	.1355	.1180
40-44	.0932	.0824	.0755	.0657	.0596	.0508
45-49	.0126	.0108	.0096	.0081	.0072	.0059
Total Fertility Rate	6.6165	6.0657	5.6986	5.1479	4.7807	4.2300

the elements of this series were derived by assuming a smooth trend, the Table 86 estimates cannot reflect true fluctuations in fertility. Hence, their year-to-year accuracy should not be interpreted too strictly.

The availability of yearly age-specific fertility schedules for the 1965-78 period, of yearly estimates of mortality (from Chapter 2), and of an adjusted age distribution for 1964 (based on Set 2 of the stable and quasi-stable estimates presented in Chapter 2 and shown in Table 87), makes it possible to estimate yearly birth rates by sex for the period. These are shown in Table 4 in the report summary. Obviously, their accuracy depends on that of all the estimates involved in their derivation. In particular, the age distribution of the female population plays an important role in determining their value, as does the total estimated size of the population. Both these elements have been derived assuming that the population is closed. Inasmuch as migration reduces the denominator more than the numerator of the weights applied to the estimated age-specific fertility rates, the true birth rates in the population may be slightly higher.

3.8 SUMMARY

According to the estimates presented earlier in Tables 3 and 4, total fertility in Colombia declined by about 36 percent between 1965 and 1978. In terms of birth rates, the decline during the same period amounted to about 32 percent. Although it is not possible to pinpoint exactly the time at which the decline started, because of the paucity of data for years prior to 1964 and the spurious fluctuations inherent in the own-children estimates, the rough trend of the latter during the 1959-65 period (see Figure 15) is relatively horizontal. Hence, it seems likely that fertility remained constant up to 1964 or 1965 at a level of about 6.6 to 6.8 children per woman. The decline started thereafter, reaching a level of about 5.0 to 5.2 by 1973, and 4.4 to 4.6 in 1976. Since it is likely that the decline has continued, a level of about 4.2 for 1978 is not implausible. However, this value is subject to greater uncertainty than the rest. It is hoped that the data gathered by the surveys conducted in 1980 and early 1981 will aid in reducing this uncertainty.

NOTES

[1]Note that because the direct and indirect estimates are affected by different types of biases, such agreement is not necessary. For example, the direct estimates are affected by truncation since those corresponding to earlier periods are based on the not altogether representative experience of relatively young women. Indirect estimates, on the other hand, are dependent on the choice of model and are differentially affected by the age-of-mother effect.

[2]This is the assumption made by Lopez. It is based, however, on fairly weak evidence since the 1938-73 growth rate estimates are themselves open to question. The fairly unchanging age distribution observed during 1938-51 lends support to the premise that the growth rate started to change at a date close to 1951, but the exact timing of its turning point cannot be known accurately. In this report, the dates 1949.5 and 1950.5 will be used in different instances to derive alternative sets of demographic estimates. Although the choice of one over the other will seem somewhat arbitrary, the uncertainty surrounding the timing of the turning point does not warrant further justification for this treatment.

[3]We wish to thank Dr. Alberto Hernandez for providing us with the tabulations required to perform these recalculations.

APPENDIX A

RESULTS OF THE 1973 CENSUS

The official 1973 census date was October 24 (or, technically, midnight of October 23). According to the census plans, all populated conglomerates with at least 500 inhabitants in the departamentos were to be enumerated on that date. The inhabitants of sparsely populated areas in the departamentos, mainly in the rural areas, were enumerated during the two weeks immediately following. The intendencias of San Andres and Providencia were also enumerated within this time frame (DANE, 1975b). During this initial stage, only the population living in household dwellings, whether private or collective, was counted.

At least three other constituents of the Colombian population were counted either at different times or by different procedures. These included the population of the national territories, the population serving in the armed forces and the Indian population living in reservations. The cabeceras (municipal capitals) of the national territories were enumerated in May and June 1974. According to DANE (1974b) the reference date for this enumeration was May 29, 1974, except in Putumayo and Amazonas, where the dates were June 2 and 12, respectively. However, the final census report (DANE, 1981) suggests that some effort was made to establish whether the enumerated population was present on October 24, 1973, therefore making possible the use of a single reference date. The rural areas of the territories were canvassed only in late 1974 (from October 1974 to February 1975) and no information could be found regarding their reference dates.

The armed forces administration undertook the enumeration of its members. The date on which this enumeration was carried out could not be established, but it was

probably close to the official census date. However, the final results of this enumeration were provided to DANE only late in 1980 (DANE, 1981) and they do not include a breakdown by age or sex.

Finally, the Indian population living in reservations seems to have been counted in at least two stages. The Cauca reservations were enumerated in late 1972 (DANE, 1977e) as part of a pilot census. The total population canvassed at that time in the Cauca amounted to 65,204 persons. The rest of the Indian population was enumerated by means of a special questionnaire at the same time as the rest of the rural population.

Even though part of the Colombian population had not yet been enumerated by October 1974, preliminary census results were published at that time (DANE, 1974a and 1974b). These results were based on a manual count of the data referring to the population in private and collective dwellings in the departamentos, the intendencias of San Andres and Providencia, and the cabeceras of the other national territories. The total count published in DANE 1974a differs from that published in the addendum (DANE 1974b) by 1,000; however, all the other numbers coincide. Apparently, the difference in the totals was due only to an addition error, which was corrected in the addendum.

Table A.1 presents the main results contained in the addendum (DANE, 1974b), as well as two revisions of the preliminary results, published by Potter and Ordonez (1976) and by DANE (1977b). The main difference between these two sets and the preliminary counts occurs in the figures referring to the national territories, which was to be expected, since the preliminary count published in 1974 refers mainly to the urban areas of the territories (the cabeceras). As shown by the decomposition of the 1974 count for the national territories, only the intendencias of San Andres and Providencia had been enumerated in their entirety by the time DANE published results in October, 1974. Furthermore, the count for the national territories appears to be a hybrid figure, since, at least according to the DANE (1974b) data, its components refer to different points in time.

Neither Potter and Ordonez (1976) nor the DANE (1977a) publication explain how the total figures for the national territories (371,542 and 394,261) were obtained. In both cases, however, the figures are labeled "not adjusted," so it seems probable that they also were derived from manual counts of the census returns. The large differ-

TABLE A.1 Preliminary, Interim, and Final Results of the 1973 Census: Colombia

Area	Reference Date	Preliminary Counts: Preliminary DANE 1974b	Preliminary Counts: Interim Potter and Ordonez 1976	Preliminary Counts: Interim DANE 1977a	Preliminary Counts: Final DANE 1981
Departamentos (excluding Bogota)	Oct. 24, 1973	17,719,592	17,695,304	17,695,308	17,491,160
Bogota	Oct. 24, 1973	2,855,065	2,863,994[a]	2,863,994[a]	2,571,548
National territories		139,794[b]	371,542	394,261	375,000
San Andres and Providencia (complete)	Oct. 24, 1973	22,719	--		
Amazonas cabeceras	June 2, 1974	6,285	--		
Putumayo cabeceras	June 12, 1974	22,916	--		
All other cabeceras	May 29, 1974	87,874	--		
Armed forces	c	--	--	66,629	53,111
Indian population in reservations:		--	267,596	--	294,416
Cauca reservations	Oct. 1972	--	--	65,204	
Total		20,714,451	21,198,436	21,085,396	20,785,235

[a]Incorporates an upward adjustment of 322,932 persons.
[b]Refers mostly to the cabeceras.
[c]Date not established, but probably near the official census date, October 1973.

ence between them and the 1974 figure can probably be attributed to the fact that it took several months to complete the enumeration of rural areas in the territories. There is one other discrepancy: The final census results (DANE, 1981) indicate that the total population in the national territories was 375,000. The difference between this figure and the DANE (1977a) figure may result from an adjustment for the use of different reference dates, however this is not stated clearly in any of the publications available.

No explanation could be found regarding the discrepancies between the 1974 figures for the departamentos and Bogota and those published later by Potter and Ordonez (1976) or DANE itself (1977a). However, the latter sources coincide in pointing out that their figure for Bogota already incorporates an upward adjustment of 322,932 persons. No explanation is provided for the necessity or the basis of this adjustment, however it implies that the raw census count of Bogota amounted only to 2,541,062. According to the final results, the true figure was 2,571,548.

The differences between the DANE pre-1981 totals for the departamentos and the final count can probably be attributed to the fact that the two preliminary counts included the "other" Indian population (that portion not living in the Cauca reservations or in the national territories). If this is the case, the Potter and Ordonez (1976) total count is too high, because it incorporates this Indian population twice.

Finally, none of the figures for the armed forces published before 1981 are derived from actual counts, and it is not clear whether the final figure (53,111) includes those serving in the police forces.

Table A-2 presents the actual, unadjusted census counts for different sectors of the population, as published by DANE in the final report (1981). The figures for the departamentos and for Bogota have been decomposed into private-household and collective-dwelling categories. At least one component of the total count does not refer to the official census date (the Indian population in the Cauca reservations), and those serving in the armed forces are usually not incorporated into most of the published tabulations because their classification by age is not available.

TABLE A.2 Official (Unadjusted) Results from the 1973 Census:

Type of Population	Count	Total
Departamentos		17,491,160
Private households	17,147,984	
Collective dwellings	343,176	
Bogota		2,571,548
Private households	2,530,467	
Collective dwellings	41,081	
National territories		375,000
Municipal capitals (cabeceras)	118,640	
Other areas	256,360	
Armed forces	53,111	53,111
Indian Population		
In the Cauca	65,204	294,416
Other (not in national territories)	229,212	
Total		20,785,235

Source: DANE (1981).

APPENDIX B

DESCRIPTION OF SAMPLING DESIGNS

B.1 THE 1969 NFS SAMPLE

The sample used in carrying out the 1969 NFS was a multistage probability sample of mixed type. First, four geographic regions were defined. The 1968 population of the municipios in each region was then estimated on the basis of the 1964 census count. Estimates of the population living in the cabecera (capital) of each municipio were also obtained. On the basis of these estimates, two types of primary sampling units (PSU) were defined. A Type-A PSU was constituted by the "rest" (all except the capital) of a municipio with 20,000 or more inhabitants in its capital. A Type-B PSU was constituted by each municipio whose capital had less than 20,000 inhabitants. The Type-A PSUs were classified into two subgroups and Type-B PSUs were classified into four subgroups, the subgrouping based on the estimated number of females aged 15-49 in each PSU. Applied in conjunction with the four geographic regions defined before, this division gave rise to 24 distinct strata. The anticipated 3,000 interviews were allocated proportionately to these strata on the basis of the estimated number of eligible women in each.

One municipio from each stratum was selected at random with a probability proportional to the number of eligible women living in it (estimated on the basis of the 1964 census). The selected municipios were then divided into census tracts or blocks, a certain number of which were selected systematically. The number of tracts selected depended on the number of questionnaires assigned (according to size of stratum) to each municipio and on the estimated number of eligible women in each tract. In rural areas (the "rest" of every municipio considered), all eligible women in selected census tracts were inter-

viewed. In semi-urban areas (municipal capitals with less than 20,000 inhabitants) only a fraction of all eligible women was interviewed. Women to be interviewed were selected by means of a systematic procedure that might have reduced a woman's probability of selection whenever she belonged to a household with more than one eligible woman.

To select the urban sample, the municipal capitals with at least 20,000 inhabitants were classified in two groups: those with a population equal to or greater than 100,000 and the rest. This grouping, applied in conjunction with the same four geographic regions defined for the rural sample, created eight strata. The cities selected to represent each stratum were either those belonging to the municipios already chosen for the rural sample or those lying close to the selected rural municipios. The city of Bogota was also included. Within the cities selected, eligible women selected for individual interviews were chosen by the same procedure used in semi-urban areas.

B.2 THE COLOMBIAN MASTER SAMPLE

The Master Sample was envisioned as a general probability sample of households in Colombia that would serve as a basis for both periodic and one-time surveys. It was designed so that surveys based on the entire sample could produce reliable estimates of health characteristics for detailed subgroupings of the population at the national level or for large subgroupings of the population at the "regional" level (e.g., for cities of 1 million persons or more, for certain departamentos, or for groups of departamentos with 2 million persons or more). The design of the Master Sample also permits the selection of subsamples for surveys that aim only to produce reliable estimates for large subgroupings at the national level.

Municipios are defined as the primary sampling units (PSUs) of the Master Sample. However, municipios with fewer than 3,000 inhabitants were combined with an adjacent municipio to form a single PSU. The 854 PSUs created in this way were classified into 225 homogeneous strata. The 37 municipios having the largest number of inhabitants were considered self-representative (SR) and each constituted a separate stratum. These strata (the SR) were of roughly equal size and were all included in the Master Sample. Among the non-self-representative

PSUs, one was selected from each of the 188 strata into which they were classified. The probability of selection of each PSU was proportional to its population size within the stratum. A controlled selection procedure was used to ensure the appropriate distribution of sample PSUs to departamentos.

The non-SR 188 strata were defined so that all the PSUs belonging to a given stratum were located within one of 12 "small" geographical regions defined for the purpose of sample design. Homogeneity within strata was established with respect to the following characteristics: (1) population size according to the 1973 census, (2) proportion of the population living in the municipal capital, and (3) mean altitude (feet above sea level) of the municipal capital.

The final sample resulting from this process was constituted by 225 PSUs, covering approximately 60,000 households and 360,000 persons. These 225 PSUs were later allocated to 6 subsamples, each being a representative probability sample of the Colombian population and of its five main geographical regions (see Table 5). Each subsample consists of the 15 largest municipios and 35 others selected from 35 new strata defined according to the same criteria outlined above. In this case, only 210 PSUs in the Master Sample are classified into these strata. They constitute the non-self-representative PSUs at this stage. A controlled selection procedure was used once more to assign every non-self-representative PSU to one and only one subsample.

Segments, groups of approximately 10 households, constitute the secondary sampling units (SSU). The Master Sample comprises 6,000 segments, 2,220 of which are located within the 15 largest PSUs (this number being proportional to the population in these PSUs). The number of segments in each PSU is proportional to its population size. The urban-rural distribution of the segments is proportional to the urban-rural population in the PSUs. The other 3,780 segments are allocated among the rest of the PSUs. Each one has about 18 segments on average, a fact that reflects the equal size of their strata.

The segments in the 15 largest PSUs belonging to every subsample were allocated to the different subsamples by a controlled selection procedure based on geographic distribution. In the remaining 35 PSUs no secondary selection of segments was necessary, since they were contained in only one sample. Every subsample comprises a total of 1,000 segments.

APPENDIX C

APPLICATION OF EL-BADRY'S METHOD TO THE 1973 CENSUS SAMPLE

TABLE C.1 Proportions of Women with Zero Parity and with Not-Stated Parity, 1973 Census Sample: Colombia

Age Group	Women with Zero Parity (Proportions)	Women with Not-Stated Parity (Proportions)
Whole Country		
15-19	.5316	.3645
20-24	.3416	.1916
25-29	.1777	.1050
30-34	.1058	.0693
35-39	.0846	.0572
40-44	.0811	.0533
45-49	.0815	.0607
Cabeceras		
15-19	.5527	.3602
20-24	.3812	.1984
25-29	.2100	.1092
30-34	.1206	.0676
35-39	.0980	.0546
40-44	.0915	.0509
45-49	.0960	.0592
Rest of Country		
15-19	.4758	.3759
20-24	.2394	.1738
25-29	.1012	.0952
30-34	.0740	.0729
35-39	.0580	.0624
40-44	.0600	.0582
45-49	.0507	.0639

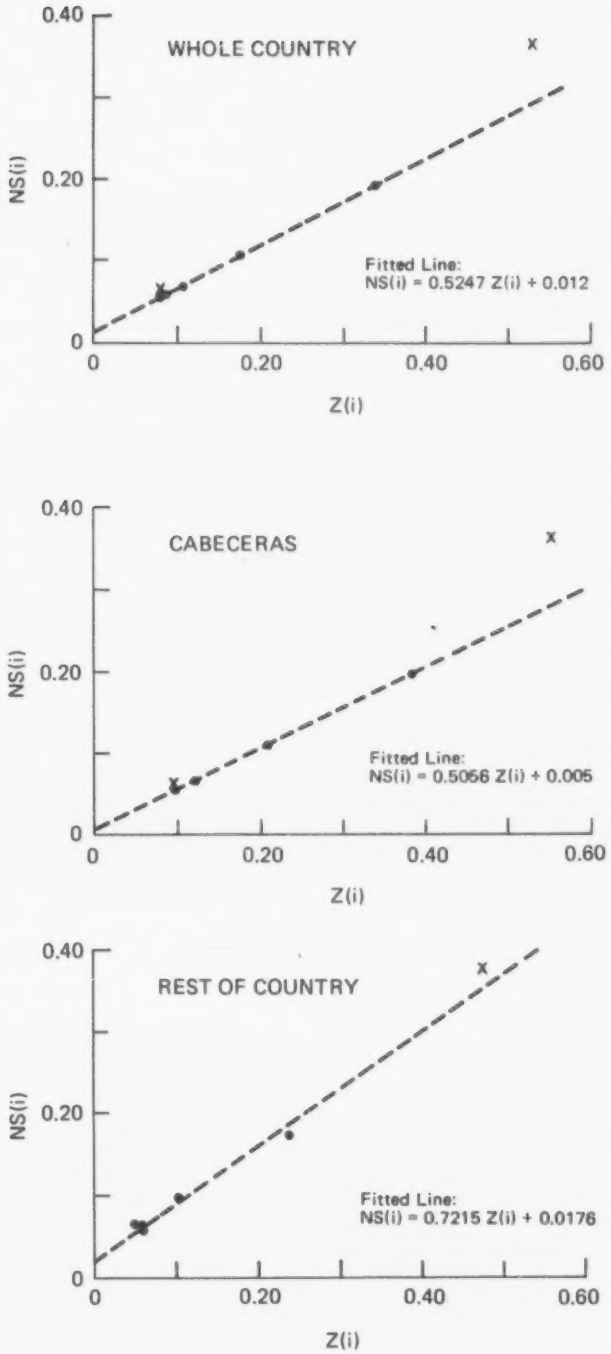


FIGURE C.1 Application of the El-Badry Adjustment for Nonresponse to the 1973 Census Sample: Colombia

APPENDIX D

DIFFERENTIAL MORTALITY ESTIMATES DERIVED FROM FERTILITY HISTORY DATA

Somoza (1980) used the detailed data from the CFS to estimate infant and child mortality over time and according to characteristics of the mother or child (region, urban or rural residence, mother's age at the birth, sex of the child, birth order, education of the mother, etc.). He investigated the plausible assumption that mortality risks vary in different subgroups of the population. To do so, separate life tables were calculated for each combination of categories of interest. Unfortunately, as in most such situations, this procedure was feasible for only a few categories, since sample sizes usually become quite small as the number of subgroups increases. In addition, it becomes increasingly difficult to summarize larger numbers of life tables.

Recently, new methods of analyzing the effects of covariates on the life table simultaneously have become available (Cox, 1972). The best-developed of these methods is the proportional hazards model, in which it is assumed that the age-specific mortality risks, for given individual characteristics, are proportional, with proportionality factors that are the same at every age (Prentice and Kalbfleisch, 1980). As in the standard life table, there is a risk of mortality at each age. In the proportional hazards model, the risk at age x is the product of two factors, one which represents the underlying age pattern of mortality and another which reflects the effect of characteristics of the individual. For example, suppose children born after 1960 have lower mortality than those born earlier and the effect is to lower the mortality risk proportionally at every age. Then let $Z_{i1} = 0$ if child i was born before 1960 and $Z_{i1} = 1$ if child i was born more recently. Then the mortality risk for this child at age x, $\mu_i(x)$, can be given by

$$\mu_i(x) = e^{\lambda(x)} e^{\beta_1 Z_{i1}}$$

where $e^{\lambda(x)}$ is the underlying age pattern of mortality and $e^{\beta_1 Z_{i1}}$ is the relative risk associated with being in the category given by Z_{i1}. Then children born before 1960 have mortality rates given by $e^{\lambda(x)}$, since their value of Z_{i1} is zero and children born later have their risks multiplied by e^{β_1}. If the hypothesis that children born later experience lower mortality rates is correct, then the estimated value of β_1 should be negative, so that e^{β_1} is less than 1. Procedures are available for estimating the value of β_1 and the coefficients for as many other covariates as we wish to add to the model.

As in the standard regression analysis, we need some way of assessing how well the model fits, i.e., how much variation is explained. In this case, if we are fitting a proportional hazards model, we ask how well the model with one covariate fits as compared to life tables calculated in the usual way separately for the pre-1960 and post-1960 periods. A chi-square test is available (see Menken et al., 1981). If the chi-square statistic is associated with a high p-value (i.e., the chance of a value as large as or larger than that observed is high), we accept the model as fitting the data well.

The same type of model can be applied if we want to use three time periods, births in 1941-59, 1960-67, and 1968-76. Then two covariates are necessary: $Z_{i1} = 1$ if child i was born in 1960-67 and zero otherwise and $Z_{i2} = 1$ if child i was born after 1967 and zero otherwise.

The results of fitting this model to the CFS data are given in Table D.1. Since both Z_{i1} and Z_{i2} are zero when the child was born prior to 1960, there is no β for that period. The coefficient for 1960-67 is negative, -0.33, indicating a mortality decline, and that for the most recent period has a greater negative value, -0.46. The effect on the mortality risks is given in the column labeled e^{β}. For 1960-67, it is estimated that the risks at each age were 72 percent of those in the earlier period and for 1968-1976, they were 63 percent--relative to the risks prior to 1960. The p-value of 0.68 indicates that the model fits quite well.

Table D.2 gives comparable values for single-factor models calculated for eight variables. In this table the

TABLE D.1 Time Period Proportional Hazards Model from the 1976 CFS: Colombia

Time Period of Birth	ß	$e^{ß}$
1960-67	-.3313	.72
1968-76	-.4586	.63

Note: p = .68

estimated standard error of each β coefficient is also shown. The p-values are high for the time period, region, and mother's age at birth models, moderate for birth order and urban-rural residence, and low for parent's education and sex of child. They indicate that the first three factors, or even the first five, can be assumed to be represented well as proportional hazards.

The results are not startling. Children of mothers living in the Central, Atlantic and Eastern-Bogota regions reported mortality rates that were, respectively, 76, 59 and 68 percent of those in the Pacific Region. As compared to infants of mothers under 20 at their birth, those born to older mothers have reduced mortality. Mortality drops by 23, 27 and 18 percent when mothers are 20-24, 25-29, and over 30, respectively. Other values of e^{β} can be interpreted similarly.

Of course, additional information is necessary to judge the plausibility of these estimates. Without knowledge of general conditions in the Atlantic region, it would be impossible to tell from this analysis that the estimated coefficient is highly suspect because of poorer reporting of child deaths.

It should also be noted that a low p-value is not necessarily accompanied by a small coefficient. In addition, a factor with a coefficient close to zero can have a high p-value, since the model with this variable included may fit nearly as well as the model that omits it.

The multivariate analysis was carried out by adding one factor at a time. The factor chosen was the one with the highest p-value. Therefore, at the first stage,

TABLE D.2 Single Factor Proportional Hazards Models from the 1976 CFS: Colombia

Factor[a]	β	S.E.$_\beta$	e^β	p
Time period of birth:				
1960-67	-.331	.058	.72	
1968-76	-.459	.060	.63	
				.68
Region:				
Central	-.271	.065	.76	
Atlantic	-.522	.076	.59	
Eastern-Bogota	-.393	.066	.68	
				.85
Mother's age at birth:				
20-24	-.255	.065	.77	
25-29	-.321	.071	.73	
30+	-.204	.070	.82	
				.69
Birth order of child:				
2-3	.285	.070	1.33	
4+	.227	.067	1.25	
				.37
Residence:				
Rural	.292	.048	1.34	
				.43
Mother's education:				
3+ years	-.463	.049	.63	
				.01
Father's education:				
3+ years	-.332	.048	.72	
				.05
Sex of child:				
Female	-.079[b]	.048	.92	
				.01

[a]The omitted categories are: time period, prior to 1960, Pacific region, mother's age < 20 at birth, birth order 1, urban residence, education less than 3 years, and male sex.
[b]Coefficient not significantly different from zero.

region was the factor selected. At the second stage, two-factor models were fitted, e.g., region by time period, region by mother's age, etc. The fit of these models was compared to the fit using region alone. The second factor selected was that in which the p-value was highest. This procedure is analogous to a stepwise

regression in which the next variable to be added is the one which increases the multiple correlation coefficient the most. Table D.3 shows the p-values at each stage. Since the region-times-mother's-age model had the highest p-value at the two-factor stage, mother's age was the next covariate to be added to the model. Successively, time period, birth order, sex, and residence were included. Table D.4 gives the coefficients and their standard errors for the best fitting models, and Table D.5 displays the relative risks.

In most cases, the coefficients change very little as additional variables are included, indicating that the effects are primarily direct ones. Notably, however, the impact of maternal age and birth order changes when both are included. In this case, very high risks are attributed to birth orders above the first and low risks to maternal ages above 20. Somoza (1980) has demonstrated a differential effect of birth order according to maternal age, which is not captured by this type of proportional hazards model. A model that includes age and birth-order interaction terms would probably be more appropriate.

At least for the first four factors (region, maternal age, time period, and birth order) the proportional hazards model appears to fit the observed data quite well and offers a reasonable way to summarize the risks associated with each category of these covariates.

Table D.6 is another demonstration of how well the proportional hazards model fits the observed data. If $_1l_1^0$ is calculated for each sub-group in the usual way and also estimated from the model to produce $_1l_1^E$, the percentage error in the estimate is given by $(_1l_1^E - {}_1l_1^0)/{}_1l_1^E)$. For the most part, these errors are less than 5 percent.

TABLE D.3 Associated p-Values for Proportional Hazards Models from the 1976 CFS: Colombia

Factor	Single Factor	Region x	Region x Age x	Region x Age x Time Period x	Region x Age x Time Period x Birth Order x	Region x Age x Time Period x Birth Order x Sex x
Time period of birth	.68	.72	.68[a]			
Region	.85[a]					
Mother's age at birth	.69	.80[a]				
Birth order of child	.37	.14		.26[a]		
Residence	.43	.42	.32	.03	.01	.01
Mother's education	.01	.01	.00	.00	--	
Father's education	.05	.15	.15	.00	--	
Sex of child	.01	.03	.05	.06	.04[a]	

[a]Factor added next.

TABLE D.4 Coefficients and Their Standard Errors for the Single-Factor and Best-Fitting Two-to-Six Factor Proportional Hazards Models from the 1976 CFS: Colombia

	Number of Factors											
	β						$S.E._{\beta}$					
Factor	1	2	3	4	5	6	1	2	3	4	5	6
Time period of birth:												
1960-67	-.331		-.336	-.348	-.346	-.349	.058		.061	.061	.061	.060
1968-76	-.459		-.464	-.464	-.463	-.482	.060		.063	.063	.063	.063
Region:												
Central	-.271	-.260	-.266	-.269	-.270	-.274	.065	.065	.065	.065	.065	.065
Atlantic	-.522	-.539	-.518	-.534	-.536	-.549	.076	.076	.076	.076	.076	.076
Eastern-Bogota	-.393	-.385	-.397	-.387	-.388	-.358	.066	.066	.067	.066	.067	.067
Mother's age at birth:												
20-24	-.255	-.266	-.238	-.406	-.407	-.386	.065	.065	.065	.069	.069	.070
25-29	-.321	-.336	-.270	-.533	-.535	-.509	.071	.071	.071	.083	.083	.083
30+	-.204	-.233	-.073	-.382	-.383	-.361	.070	.070	.074	.092	.092	.092
Birth order of child:												
2-3	.285			.435	.434	.423	.070			.072	.072	.072
4+	.227			.549	.550	.515	.067			.083	.083	.084
Residence:												
Rural	.292					.284	.048					.049
Mother's education:												
3+ years	-.463						.049					
Father's education:												
3+ years	-.332						.048					
Sex of child:												
Female	-.079				-.083	-.081	.048				.048	.048

TABLE D.5 Relative Risks (e^{β}) for the Single Factor and Best-Fitting Two-to-Six-Factor Proportional Hazards Models from the 1976 CFS: Colombia

	Number of Factors					
Factor	1	2	3	4	5	6
Time period of birth:						
1960-67	.72		.72	.71	.71	.71
1968-76	.63		.63	.63	.63	.62
Region:						
Central	.76	.77	.77	.76	.76	.76
Atlantic	.59	.58	.60	.59	.59	.58
Eastern-Bogota	.68	.68	.67	.68	.68	.70
Mother's age at birth:						
20-24	.77	.77	.79	.67	.67	.68
25-29	.73	.71	.76	.59	.59	.60
30+	.82	.79	.93	.68	.68	.70
Birth order of child:						
2-3	1.33			1.54	1.54	1.53
4+	1.25			1.73	1.73	1.67
Residence:						
Rural	1.34					1.33
Mother's education:						
3+ years	.63					
Father's education:						
3+ years	.72					
Sex of child:						
Female	.92				.92	.92

TABLE D.6 Percentage Error[a] in Survival to Age 1 Estimated from the Four-Factor Proportional Hazards Model from the 1976 CFS: Colombia

Mother's Age	Birth Order	Pacific			Central			Atlantic			Eastern-Bogota		
		Before 1960	1960-1967	1968-1976	Before 1960	1960-1967	1968-1976	Before 1960	1960-1967	1968-1976	Before 1960	1960-1967	1968-1976
Less than 20	1	0.1	6.8	3.7	-0.0	-4.1	1.2	-4.6	1.0	2.3	3.5	-3.0	-0.2
	2-3	-4.9	-1.0	3.6	3.7	4.2	-3.3	3.5	0.6	1.8	-0.9	-0.4	-5.1
	4+	--	--	--	10.7	--	--	6.8	--	--	0.5	--	--
20-24	1	0.6	0.9	2.7	2.6	1.8	-0.2	0.5	-1.8	-0.2	-0.7	0.3	-2.6
	2-3	2.7	6.8	-1.5	-2.4	-1.9	-0.7	-9.1	-2.5	1.9	-1.1	1.8	-0.5
	4+	-3.4	-2.3	-3.7	1.6	-2.1	-0.4	-2.7	-1.5	-0.5	6.7	4.4	-0.4
25-29	1	1.1	10.0	4.6	-3.3	2.4	1.4	5.7	--	8.0	-5.6	5.1	2.0
	2-3	12.2	-5.0	0.3	5.4	-0.3	-0.1	-4.2	0.4	-0.2	-1.0	-0.5	-0.2
	4+	-4.6	1.0	-1.4	0.1	0.7	-3.4	-2.7	-0.7	1.3	0.7	-0.3	0.4
30+	1	--	-6.7	6.0	--	-5.2	8.8	--	--	-3.6	--	32.4	1.3
	2-3	--	-4.5	-4.5	-2.0	--	-7.0	--	22.9	9.7	8.5	3.7	-0.2
	4+	-8.3	-6.4	1.8	-1.3	-0.2	1.1	-0.4	-1.2	-1.3	2.8	2.0	-0.3

[a]Cells containing fewer than 10 infants are omitted.

APPENDIX E

POPULATION ESTIMATES AND AGE DISTRIBUTION OF THE POPULATION

Table E.1 presents the census counts consistent with the growth rates of Sets 1 and 2 described in Chapter 2, and with the adjusted population sex ratios, 1938-64. Table E.2 shows population estimates based on stable and quasi-stable estimates, 1951-64.

As a by-product of the fertility and mortality estimation undertaken in this report, adjusted estimates of the population's age distribution in 1964 and in 1973 were obtained. When these are coupled with the estimates of census counts derived in conjunction with the stable and quasi-stable estimates (Table E.1, Set 2), the completeness of enumeration of the last three censuses can be estimated. Table E.3 shows the adjusted age distributions for 1964 and 1973, and Table E.4 shows the observed and estimated census counts of 1951, 1964, and 1973. It is important to note that these estimated counts do not make any allowance for the existence of a net out-migrant flow. If, as suggested by Arbalaez (1977), about 557,000 persons left Colombia during the 1964-73 period, then the completeness of the 1973 census count would be 0.913, very close to that estimated by the post-enumeration survey.

TABLE E.1 Census Counts Consistent with the Growth Rates of Sets 1 and 2, and with Adjusted Population Sex Ratios, 1938-64: Colombia

Census Date	Estimated Count		Sex Ratio[a]	Estimates of Completeness	
	Male	Female		Male	Female
Set 1					
1938	4,411,999	4,389,313	1.0052(1)	0.9774	1.0000
1951	5,998,815	5,967,969	1.0052(1)	0.9301	0.9466
1964	8,910,782	8,869,856	1.0046(2)	0.9668	1.0000
Set 2					
1938	4,410,382	4,389,313	1.0048(1)	0.9778	1.0000
1951	6,027,708	5,998,913	1.0048(1)	0.9256	0.9417
1964	8,901,787	8,869,856	1.0036(3)	0.9678	1.0000

[a]The population sex ratios have been adjusted to be consistent with the estimated birth rates and the following sex ratios at birth: (1) 1.050, (2) 1.044, (3) 1.034.

TABLE E.2 Population Estimates Based on Stable and Quasi-Stable Estimates, 1951-64: Colombia

Case	Estimated Population in 1951	Estimated Population Aged 13 and Over in 1964	Estimated Intercensal Deaths
Set 1			
Male	5,998,815	5,209,504	789,311
Female	5,967,969	5,243,789	724,180
Set 2			
Male	6,027,708	5,230,886	796,822
Female	5,998,913	5,260,047	738,866

TABLE E.3 Adjusted Age Distributions by Sex, 1964 and 1973: Colombia

Age Group	1964		1973	
	Male	Female	Male	Female
0-1	388,765	378,733	395,912	385,474
1-2	357,138	349,579	385,434	376,007
2-3	335,977	328,818	379,986	370,664
3-4	317,246	311,688	376,446	367,792
4-5	299,780	295,535	373,133	364,826
5-9	1,295,298	1,278,723	1,816,195	1,792,542
10-14	1,037,385	1,021,349	1,529,340	1,516,218
15-19	873,462	858,528	1,213,573	1,202,079
20-24	753,218	741,356	973,539	963,760
25-29	644,421	636,053	821,010	813,264
30-34	547,486	542,132	701,822	697,458
35-39	462,545	459,549	595,248	594,194
40-44	388,530	387,829	501,113	502,999
45-49	323,535	325,815	419,418	423,478
50-54	264,033	269,860	346,620	352,588
55-59	209,114	218,677	279,259	288,136
60-64	158,613	170,936	216,006	228,468
65-69	112,471	126,260	156,902	172,273
70-74	71,724	85,305	103,534	119,539
75-79	38,904	50,094	58,604	72,419
80+	22,149	33,047	35,356	49,485
Total	8,901,787	8,869,856	11,678,446	11,653,654

TABLE E.4 Estimates of Completeness of Census Enumeration, 1951, 1964, and 1973: Colombia

	Actual Count		Estimated Population[a]		Completeness
Year	Male	Female	Male	Female	Both Sexes
1951	5,579,259	5,649,250	6,027,708	5,998,913	.934
1964	8,614,652	8,869,856	8,901,787	8,869,856	.984
1973	10,210,256[b]	10,574,979	11,678,446	11,653,654	.891

[a]These estimates are obtained from the series of estimated fertility and mortality schedules presented in the main body of this report. The 1951 estimates are consistent with the Set 2 stable parameters of Table 43. In all cases, net migration is assumed to be nil.

[b]Includes armed forces.

APPENDIX F

ESTIMATED LIFE TABLES BY SEX,
1950, 1955, 1960, 1965, 1970, AND 1975

TABLE F.1 Estimated Life Tables by Sex, 1950: Colombia

MALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.891547	43.70874	43.709	0.0
1	0.838130	0.819940	42.81720	51.087	0.161870
2	0.801750	0.793545	41.99727	52.382	0.198250
3	0.785340	0.779955	41.20374	52.466	0.214660
4	0.774570	0.770440	40.42378	52.189	0.225430
5	0.766310	3.779058	39.65335	51.746	0.233690
10	0.746690	3.704607	35.87430	48.044	0.253310
15	0.733790	3.620343	32.16969	43.840	0.266210
20	0.713480	3.505048	28.54936	40.014	0.286520
25	0.687960	3.372508	25.04433	36.404	0.312040
30	0.660220	3.227592	21.67183	32.825	0.339780
35	0.630490	3.073503	18.44424	29.254	0.369510
40	0.598600	2.901258	15.37075	25.678	0.401400
45	0.561580	2.688134	12.46949	22.204	0.438420
50	0.515030	2.449463	9.78136	18.992	0.484970
55	0.463200	2.163803	7.33189	15.829	0.536800
60	0.400350	1.818683	5.16809	12.909	0.599650
65	0.325240	1.416864	3.34941	10.298	0.674760
70	0.240470	0.985655	1.93254	8.037	0.759530
75	0.154560	0.580560	0.94689	6.126	0.845440
80	0.080680	0.366330	0.36633	4.541	0.919320

FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.910644	46.73459	46.735	0.0
1	0.862530	0.844270	45.82396	53.127	0.137470
2	0.826010	0.817585	44.97969	54.454	0.173990
3	0.809160	0.803570	44.16211	54.578	0.190840
4	0.797980	0.793660	43.35855	54.335	0.202020
5	0.789340	3.887464	42.56490	53.925	0.210660
10	0.767790	3.808013	38.67744	50.375	0.232210
15	0.754660	3.726298	34.86945	46.205	0.245340
20	0.735000	3.614388	31.14316	42.372	0.265000
25	0.710160	3.484982	27.52878	38.764	0.289840
30	0.682990	3.342544	24.04381	35.204	0.317010
35	0.653680	3.190063	20.70128	31.669	0.346320
40	0.622010	3.034122	17.51123	28.153	0.377990
45	0.590420	2.871008	14.47711	24.520	0.409580
50	0.555080	2.665318	11.60610	20.909	0.444920
55	0.509560	2.411833	8.94078	17.546	0.490440
60	0.453170	2.097044	6.52895	14.407	0.546830
65	0.383420	1.714213	4.43191	11.559	0.616580
70	0.300370	1.275455	2.71769	9.048	0.699630
75	0.209240	0.822890	1.44224	6.893	0.790760
80	0.121700	0.619350	0.61935	5.089	0.878300

TABLE F.2 Estimated Life Tables by Sex, 1955: Colombia

MALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.909617	46.81665	46.817	0.0
1	0.865100	0.848305	45.90704	53.066	0.134900
2	0.831510	0.823805	45.05875	54.189	0.168490
3	0.816100	0.811005	44.23495	54.203	0.183900
4	0.805910	0.801975	43.42395	53.882	0.194090
5	0.798040	3.935182	42.62198	53.408	0.201960
10	0.777970	3.857763	38.68680	49.728	0.222030
15	0.764820	3.778769	34.82904	45.539	0.235180
20	0.745860	3.670757	31.05028	41.630	0.254140
25	0.721860	3.545558	27.37953	37.929	0.278140
30	0.695540	3.407424	23.83398	34.267	0.304460
35	0.667070	3.259058	20.42657	30.621	0.332930
40	0.636210	3.094778	17.16753	26.984	0.363790
45	0.601270	2.899137	14.07275	23.405	0.398730
50	0.558650	2.673493	11.17362	20.001	0.441350
55	0.509120	2.397658	8.50012	16.696	0.490880
60	0.447780	2.056034	6.10247	13.628	0.552220
65	0.372330	1.644693	4.04643	10.868	0.627670
70	0.283840	1.183669	2.40174	8.462	0.716160
75	0.189640	0.726820	1.21807	6.423	0.810360
80	0.103720	0.491250	0.49125	4.736	0.896280

FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.925608	50.01714	50.017	0.0
1	0.885550	0.869100	49.09154	55.436	0.114450
2	0.852650	0.844935	48.22244	56.556	0.147350
3	0.837220	0.832065	47.37752	56.589	0.162780
4	0.826910	0.822905	46.54546	56.288	0.173090
5	0.818900	4.035792	45.72256	55.834	0.181100
10	0.797910	3.958263	41.68678	52.245	0.202090
15	0.785360	3.884618	37.72853	48.040	0.214640
20	0.767700	3.783773	33.84392	44.085	0.232300
25	0.745250	3.666323	30.06015	40.336	0.254750
30	0.720480	3.535968	26.39383	36.634	0.279520
35	0.693540	3.395093	22.85786	32.958	0.306460
40	0.664130	3.249168	19.46278	29.306	0.335870
45	0.634410	3.095348	16.21362	25.557	0.365590
50	0.600990	2.899822	13.11827	21.828	0.399010
55	0.557400	2.654818	10.21845	18.332	0.442600
60	0.502380	2.343758	7.56363	15.056	0.497620
65	0.432580	1.954319	5.21988	12.067	0.567420
70	0.346680	1.491134	3.26556	9.420	0.653320
75	0.248430	0.991485	1.77442	7.143	0.751570
80	0.149360	0.782940	0.78294	5.242	0.850640

TABLE F.3 Estimated Life Tables by Sex, 1960: Colombia

MALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.926648	50.27802	50.278	0.0
1	0.890520	0.875400	49.35138	55.419	0.109480
2	0.860280	0.853215	48.47598	56.349	0.139720
3	0.846150	0.841435	47.62277	56.282	0.153850
4	0.836720	0.833055	46.78134	55.910	0.163280
5	0.829390	4.090909	45.94829	55.400	0.170610
10	0.809370	4.012444	41.85739	51.716	0.190630
15	0.796240	3.939778	37.84496	47.530	0.203760
20	0.778900	3.840549	33.90518	43.530	0.221100
25	0.756760	3.724498	30.06464	39.728	0.243240
30	0.732240	3.595198	26.34015	35.972	0.267760
35	0.705460	3.454873	22.74496	32.241	0.294540
40	0.676110	3.301163	19.29010	28.531	0.323890
45	0.643840	3.126847	15.98894	24.834	0.356160
50	0.606040	2.919064	12.86209	21.223	0.393960
55	0.559930	2.659502	9.94303	17.758	0.440070
60	0.501580	2.329659	7.28353	14.521	0.498420
65	0.427620	1.918098	4.95387	11.585	0.572380
70	0.337180	1.433994	3.03577	9.003	0.662820
75	0.233410	0.923835	1.60177	6.804	0.766590
80	0.135980	0.677940	0.67794	4.986	0.864020

FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.937817	53.60393	53.604	0.0
1	0.907560	0.893035	52.66612	58.030	0.092440
2	0.878510	0.871455	51.77310	58.933	0.121490
3	0.864400	0.859755	50.90166	58.887	0.135600
4	0.855110	0.851480	50.04192	58.521	0.144890
5	0.847850	4.182384	49.19044	58.018	0.152150
10	0.827840	4.108278	45.00807	54.368	0.172160
15	0.816080	4.043472	40.89980	50.117	0.183920
20	0.800610	3.954823	36.85632	46.035	0.199390
25	0.780800	3.850858	32.90150	42.138	0.219200
30	0.758800	3.734533	29.05066	38.285	0.241200
35	0.734650	3.607662	25.31613	34.460	0.265350
40	0.708040	3.474488	21.70848	30.660	0.291960
45	0.680760	3.333098	18.23399	26.785	0.319240
50	0.649960	3.152043	14.90091	22.926	0.350040
55	0.609310	2.921253	11.74887	19.282	0.390690
60	0.556960	2.621344	8.82761	15.850	0.443040
65	0.488750	2.233933	6.20627	12.698	0.511250
70	0.401740	1.753609	3.97233	9.888	0.598260
75	0.297400	1.207794	2.21873	7.460	0.702600
80	0.185950	1.010932	1.01093	5.437	0.814050

TABLE F.4 Estimated Life Tables by Sex, 1965: Colombia

MALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.936248	53.40178	53.402	0.0
1	0.908010	0.896700	52.46555	57.781	0.091990
2	0.885390	0.880255	51.56885	58.244	0.114610
3	0.875120	0.870655	50.68860	57.922	0.124880
4	0.866190	0.862675	49.81795	57.514	0.133810
5	0.859160	4.217843	48.95528	56.980	0.140840
10	0.834610	4.137664	44.73744	53.603	0.165390
15	0.821760	4.070948	40.59979	49.406	0.178240
20	0.805900	3.979898	36.52885	45.327	0.194100
25	0.785520	3.872653	32.54897	41.436	0.214480
30	0.762770	3.752143	28.67632	37.595	0.237230
35	0.737700	3.620183	24.92418	33.786	0.262300
40	0.709970	3.477183	21.30400	30.007	0.290030
45	0.680320	3.322868	17.82683	26.204	0.319680
50	0.647080	3.133348	14.50397	22.414	0.352920
55	0.604640	2.892398	11.37062	18.806	0.395360
60	0.550000	2.579753	8.47822	15.415	0.450000
65	0.479010	2.177973	5.89847	12.314	0.520990
70	0.389060	1.684479	3.72070	9.563	0.610940
75	0.282700	1.134464	2.03622	7.203	0.717300
80	0.171870	0.901755	0.90175	5.247	0.828130

FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.943374	56.74768	56.748	0.0
1	0.920370	0.907930	55.80432	60.632	0.079630
2	0.895490	0.890490	54.89639	61.303	0.104510
3	0.885490	0.881305	54.00591	60.990	0.114510
4	0.877120	0.873830	53.12460	60.567	0.122880
5	0.870540	4.298433	52.25078	60.021	0.129460
10	0.851670	4.228333	47.95235	56.304	0.148330
15	0.840720	4.171147	43.72401	52.008	0.159280
20	0.827120	4.093042	39.55287	47.820	0.172880
25	0.809630	4.000978	35.45984	43.798	0.190370
30	0.790090	3.897327	31.45886	39.817	0.209910
35	0.768490	3.783453	27.56154	35.865	0.231510
40	0.744580	3.661614	23.77809	31.937	0.255490
45	0.719650	3.533652	20.11548	27.952	0.280350
50	0.691520	3.367642	16.58183	23.979	0.308480
55	0.654030	3.153088	13.21420	20.204	0.345970
60	0.604970	2.868872	10.06111	16.631	0.395030
65	0.539600	2.491732	7.19224	13.329	0.460400
70	0.453550	2.006639	4.70050	10.364	0.546450
75	0.345890	1.428219	2.69387	7.788	0.654110
80	0.224490	1.265647	1.26565	5.638	0.775510

TABLE F.5 Estimated Life Tables by Sex, 1970: Colombia

MALES

AGE X	1(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.942140	54.26334	54.263	0.0
1	0.920680	0.911240	55.32120	60.087	0.079320
2	0.901800	0.897530	54.40996	60.335	0.098200
3	0.893260	0.889515	53.51244	59.907	0.106740
4	0.885770	0.882820	52.62292	59.409	0.114230
5	0.879870	4.339998	51.74011	58.804	0.120130
10	0.860550	4.270013	47.40012	55.081	0.139450
15	0.848840	4.210423	43.13011	50.811	0.151160
20	0.834670	4.128763	38.91969	46.629	0.165330
25	0.816320	4.031738	34.79094	42.619	0.183680
30	0.795640	3.921662	30.75920	38.660	0.204360
35	0.772630	3.799863	26.83754	34.735	0.227370
40	0.746900	3.664924	23.03769	30.844	0.253100
45	0.718690	3.517814	19.37277	26.956	0.281310
50	0.687040	3.338113	15.85496	23.077	0.312960
55	0.646570	3.106338	12.51685	19.359	0.353430
60	0.593550	2.799527	9.41051	15.855	0.406450
65	0.523110	2.394848	6.61099	12.638	0.476890
70	0.431270	1.882354	4.21614	9.776	0.568730
75	0.318860	1.289914	2.33378	7.319	0.681140
80	0.197230	1.043870	1.04387	5.293	0.802770

FEMALES

AGE X	1(X)	L(X)	T(X)	E(X)	Q(X)
0	1.000000	0.948685	59.78659	59.787	0.0
1	0.930910	0.920250	58.83791	63.205	0.069090
2	0.909590	0.906710	57.91766	63.674	0.090410
3	0.903830	0.900250	57.01096	63.077	0.096170
4	0.896670	0.893840	56.11072	62.577	0.103330
5	0.891010	4.420393	55.21689	61.971	0.108990
10	0.877880	4.360668	50.79651	57.863	0.122120
15	0.867800	4.310868	46.43585	53.510	0.132200
20	0.856000	4.242904	42.12498	49.211	0.144000
25	0.840730	4.162188	37.88210	45.059	0.159270
30	0.823530	4.070514	33.71991	40.946	0.176470
35	0.804340	3.968043	29.64940	36.862	0.195660
40	0.782830	3.858303	25.68056	32.805	0.217170
45	0.759800	3.737078	21.82227	28.721	0.240200
50	0.733260	3.582023	18.08519	24.664	0.266740
55	0.698050	3.378678	14.50317	20.777	0.301950
60	0.651130	3.103683	11.12449	17.085	0.348870
65	0.587160	2.720969	8.02081	13.660	0.412840
70	0.500400	2.230728	5.29184	10.575	0.499600
75	0.387820	1.613258	3.06111	7.893	0.612180
80	0.255640	1.447853	1.44785	5.664	0.744360

TABLE F.6 Estimated Life Tables by Sex, 1975: Colombia

MALES

AGE X	l(X)	L(X)	T(X)	E(X)	θ(X)
0	1.000000	0.947637	58.74170	58.742	0.0
1	0.931030	0.922610	57.79407	62.075	0.068970
2	0.914190	0.910410	56.87146	62.210	0.085810
3	0.906630	0.903230	55.96106	61.724	0.093370
4	0.899830	0.897140	55.05783	61.187	0.100170
5	0.894450	4.435878	54.16071	60.552	0.105550
10	0.881130	4.375504	49.72484	56.433	0.118870
15	0.870480	4.322264	45.34933	52.097	0.129520
20	0.857810	4.248968	41.02708	47.828	0.142190
25	0.841290	4.161287	36.77812	43.716	0.158710
30	0.822530	4.061013	32.61684	39.654	0.177470
35	0.801480	3.949048	28.55583	35.629	0.198520
40	0.777720	3.822584	24.60680	31.640	0.222280
45	0.751090	3.683474	20.78423	27.672	0.248910
50	0.721200	3.514344	17.10075	23.712	0.278800
55	0.682910	3.293433	13.58641	19.895	0.317090
60	0.632000	2.995823	10.29298	16.286	0.368000
65	0.562990	2.594088	7.29715	12.961	0.437010
70	0.470630	2.070128	4.70307	9.993	0.529370
75	0.353830	1.442999	2.63294	7.441	0.646170
80	0.222710	1.189939	1.18994	5.343	0.777290

FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)	θ(X)
0	1.000000	0.953653	62.30685	62.307	0.0
1	0.939750	0.929665	61.35321	65.287	0.060250
2	0.919580	0.916610	60.42355	65.708	0.080420
3	0.913640	0.910040	59.50696	65.132	0.086360
4	0.906440	0.903565	58.59692	64.645	0.093560
5	0.900690	4.484623	57.69336	64.055	0.099310
10	0.893160	4.448419	53.20874	59.574	0.106840
15	0.885960	4.411717	48.76033	55.037	0.114040
20	0.878720	4.361167	44.34862	50.470	0.121280
25	0.865360	4.290342	39.98746	46.209	0.134640
30	0.850210	4.209332	35.69713	41.986	0.149790
35	0.833200	4.118798	31.48781	37.791	0.166800
40	0.813960	4.018269	27.36902	33.625	0.186040
45	0.792800	3.906346	23.35075	29.454	0.207200
50	0.768000	3.761743	19.44539	25.320	0.232000
55	0.735230	3.571012	15.68365	21.332	0.264770
60	0.690880	3.308309	12.11263	17.532	0.309120
65	0.629140	2.941639	8.80433	13.994	0.370860
70	0.543100	2.438787	5.86269	10.795	0.456900
75	0.427540	1.792058	3.42390	8.008	0.572460
80	0.286380	1.631841	1.63184	5.698	0.713620

GLOSSARY

AGE HEAPING A tendency for enumerators or respondents to report certain ages instead of others; also called age preference or digit preference. Preference for ages ending in 0 or 5 is widespread.

AGE PATTERN OF FERTILITY The relative distribution of a set of age-specific fertility rates. It expresses the relative contribution of each age group to total fertility.

AGE RATIO The ratio of the population in a given age group to the average of the populations in the two neighboring age groups, times 100.

AGE-SPECIFIC FERTILITY RATE The number of births occurring during a specified period to women of a specified age or age group, divided by the number of person-years-lived during that period by women of that age or age group. When an age-specific fertility rate is calculated for a calendar year, the number of births to women of the specified age is usually divided by the midyear population of women of that age.

AGE-SPECIFIC MORTALITY RATE The number of deaths occurring during a specified period to persons (usually specified by sex) of a specified age or age group, divided by the number of person-years-lived during that period by the persons of that age or age group. When an age-specific mortality rate is calculated for a calendar year, the number of deaths to persons of the specified age is usually divided by the midyear population of persons of that age. Age-specific mortality rates are generally denoted by ${}_nM_x$, the annual death rate to persons aged x to x + n.

AGE STANDARDIZATION A procedure of adjustment of crude rates (birth, death, or other rates) designed to

reduce the effect of differences in age structure when comparing rates for different populations.

BIRTH HISTORY A report of the number and dates of all live births experienced by a particular woman; see also pregnancy history. The sex of each child, the survival of each child to the date of the interview, and, where pertinent, the date of death are also generally recorded.

BIRTH ORDER The ordinal number of a given live birth in relation to all previous live births of the same woman (e.g., 5 is the birth order of the fifth live birth occurring to the same woman).

BIRTH RATE See crude birth rate.

CHANDRASEKARAN-DEMING TECHNIQUE A procedure to estimate the coverage of two independent systems collecting information about demographic or other events, based on the assumption that the probability of an event being recorded by one system is the same whether or not the event is recorded by the other system. The events from both systems are matched to establish M, the number of events recorded by both systems; U_1, the number recorded only by system 1; and U_2, the number recorded only by system 2. The Chandrasekaran-Deming formula then estimates total events, N, as

$$\hat{N} = M + U_1 + U_2 + \frac{U_1 U_2}{M}.$$

CHILDBEARING AGES The span within which women are capable of bearing children, generally taken to be from age 15 to age 49 or, sometimes, to age 44.

CHILDREN EVER BORN(E) The number of children ever borne alive by a particular woman; synonymous with parity. In demographic usage, stillbirths are specifically excluded.

COHORT A group of individuals who experienced the same class of events in the same period. Thus an age cohort is a group of people born during a particular period, and a marriage cohort is a group of people who married during a particular period. The effects of a given set of mortality or fertility rates are often illustrated by applying them to hypothetical cohorts.

COHORT FERTILITY The fertility experienced over time by a group of women or men who form a birth or a marriage cohort. The analysis of cohort fertility is contrasted with that of period fertility.

CRUDE BIRTH RATE The number of births in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as births per 1,000 population. The crude birth rate for a single year is usually calculated as the number of births during the year divided by the midyear population.

CRUDE DEATH RATE The number of deaths in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as deaths per 1,000 population. The crude death rate for a single year is usually calculated as the number of deaths during the year divided by the midyear population.

CUMULATED FERTILITY An estimate of the average number of children ever borne by women of some age x, obtained by cumulating age-specific fertility rates up to age x; also often calculated for age groups.

DEATH RATE See crude death rate.

DE FACTO POPULATION A population enumerated on the basis of those present at a particular time, including temporary visitors and excluding residents temporarily absent. See de jure population.

DE JURE POPULATION A population enumerated on the basis of normal residence, excluding temporary visitors and including residents temporarily absent. See de facto population.

DIGITAL PREFERENCE See age heaping.

DUAL RECORD SYSTEM See Chandrasekaran-Deming Technique

EXPECTATION OF LIFE AT BIRTH The average number of years that a member of a cohort of births would be expected to live if the cohort were subject to the mortality conditions expressed by a particular set of age-specific mortality rates. Denoted by the symbol e(o) in life table notation.

FERTILITY HISTORY Either a birth history or a pregnancy history.

FORWARD SURVIVAL A procedure for estimating the age distribution at some later date by projecting forward an observed age distribution. The procedure uses survival ratios, often obtained from model life tables. The procedure is basically a form of population projection without the introduction of new entrants (births) to the population.

GENERAL FERTILITY RATE The ratio of the number of live births in a period to the number of person-years-lived by women of childbearing ages during the period. The

general fertility rate for a year is usually calculated as the number of births divided by the number of women of childbearing ages at midyear.

GROSS REPRODUCTION RATE The average number of female children a woman would have if she survived to the end of her childbearing years and if, throughout, she were subject to a given set of age-specific fertility rates and a given sex ratio at birth. This number provides a measure of replacement fertility in the absence of mortality.

GROWTH RATE The increase or decrease of a population in a period divided by the number of person-years-lived by the population during the same period. The increase in a population is the result of a surplus (or deficit) of births over deaths and a surplus (or deficit) of immigrants over emigrants. (The annual increase is often expressed as a fraction of the total population at the beginning of the year, but this convention has the inconvenient characteristic of not being readily defined for a five-year interval and of being unequal to the difference between the birth rate and the death rate even in the absence of migration.) See also rate of natural increase.

INFANT MORTALITY RATE The number of deaths of children under 1 year of age occurring in the same year; also used in a more rigorous sense to mean the number of deaths that would occur under 1 year of age in a life table with a radix of 1,000, in which sense it is denoted by the symbol ${}_1q_0$.

LIFE TABLE A listing of the number of survivors at different ages (up to the highest age attained) in a hypothetical cohort subject from birth to a particular set of age-specific mortality rates. The rates are usually those observed in a given population during a particular period of time. The survivors of the radix to age x are generally denoted by $l(x)$. The tabulations commonly accompanying a life table include other features of the cohort's experience: its expectation of life at each age x, denoted by $e(x)$; the probability of surviving from each age x to age $x + n$, denoted by ${}_nq_x$; the person-years-lived by the hypothetical cohort as it ages from age x to age $x + n$, denoted by ${}_nL_x$ (also equivalent to the population aged x, $x + n$ in a stationary population experiencing a number of births each year equal to the radix of the life table); and the person-years-lived

by the hypothetical cohort from age x onward, denoted by T(x).

LOGIT The logit of a proportion p is 1/2 ln[p/(1 - p)]. As a linearizing transformation, the logit has been proposed as the basis of a model life table system in which the logit of a probability of dying by age x ($_xq_o$) is related linearly to the logit of a standard probability of dying by age x ($_xq_o^s$) so that

$$\text{logit } (_xq_o) = \alpha + \beta \, [\text{logit } (_xq_o^s)],$$

where α is a measure of mortality level relative to the standard and β is a parameter that alters the shape of the standard mortality function.

MARITAL FERTILITY Any measure of fertility in which the births (in the numerator) are births to married women and in which the number of person-years-lived (in the denominator) also pertains to married women. In some instances, the designation "married" includes persons in consensual unions.

MEDIAN The value associated with the central member of a set that is ordered by size or some other characteristic expressed in numbers.

MEAN AGE OF CHILDBEARING The average age at which a mortality-free cohort of women bear their children according to a set of age-specific fertility rates.

MEAN AGE OF CHILDBEARING IN THE POPULATION The average age of the mothers of the children born in a population during a year. This measure incorporates the effects of both mortality and the age distribution.

MIGRATION RATE Number of migrants during a specified period divided by the person-years-lived of the population exposed to migration. Also see population change due to migration.

MODEL LIFE TABLE An expression of typical mortality experience derived from a group of observed life tables.

MOVING AVERAGES The successive averaging of two or more adjacent values of a series in order to remove sharp fluctuations.

MYERS INDEX An index of digit preference that essentially sums in turn the population ending in each digit over some age range, often 10-89, expressing the total as a percentage of the total population, and which avoids the bias introduced by the fact that the population is not evenly distributed among all ages by repeating the calculations 10 times, once for each

starting digit, and averaging the results. The difference between the average percentage for each digit and the expected value of 10 percent provides a measure of the preference for or avoidance of the digit over the age range considered.

NATURAL FERTILITY The age pattern of marital fertility observed in non-contraceptive populations where reproductive behavior is not affected by the number of children already born.

NET MIGRATION The difference between gross immigration and gross emigration.

NET REPRODUCTION RATE The average number of female children born per woman in a cohort subject to a given set of age-specific fertility rates, a given set of age-specific mortality rates, and a given sex ratio at birth. This rate measures replacement fertility under given conditions of fertility and mortality: it is the ratio of daughters to mothers assuming continuation of the specified conditions of fertility and mortality.

OWN-CHILDREN METHOD A refinement of the reverse-survival procedure for fertility estimation, whereby estimates of age-specific fertility rates for the recent past are obtained by relating mothers to their own children, using information on relationship and other characteristics available from a census or survey.

PARITY See children ever born.

PARTIAL BIRTH RATE The proportion of the population that enters (that is, is "born" into) a given age category in a year. The age categories used are normally open-ended, thus the partial birth rate x+ designates the proportion of the population becoming x years and older.

PARTIAL DEATH RATE The proportion of the population that leaves (that is, "dies" out of) a given age category in a year. See partial birth rate.

PERIOD FERTILITY The fertility experienced during a particular period of time by women from all relevant birth or marriage cohorts; see also cohort fertility.

P/F RATIO METHOD A consistency check for survey information on fertility. Information on recent fertility is cumulated to obtain measures that are equivalent to average parities. Lifetime fertility in the form of reported average parities by age group (P) can then be compared for consistency with the parity-equivalents (F) by calculating the ratio P/F for successive age groups. If certain assumptions

about error patterns are met, an improved estimate of fertility can sometimes be obtained by correcting the age pattern of current fertility to agree with the level of lifetime fertility reported by younger women.

POPULATION CHANGE DUE TO MIGRATION The sum of in-migrants minus out-migrants during a specified period of time. The change may also be expressed as a rate by dividing the change by person-years-lived in the population during the same period.

PREGNANCY HISTORY A report of the number and the dates of occurrence of all the pregnancies experienced by a particular woman. The outcome of the pregnancy--live birth, stillbirth, fetal death--is also recorded.

RADIX The hypothetical birth cohort of a life table. Common values are 1, 1,000, and 100,000.

RATE OF NATURAL INCREASE The difference between the births and deaths occurring during a given period divided by the number of person-years-lived by the population during the same period. This rate, which specifically excludes changes resulting from migration, is the difference between the crude birth rate and the crude death rate.

RETROSPECTIVE SURVEY A survey that obtains information about demographic events that occurred in a given past period, generally terminating at the time of the survey.

REVERSE PROJECTION See reverse survival.

REVERSE SURVIVAL A technique to estimate an earlier population from an observed population, allowing for those members of the population who would have died according to observed or assumed mortality conditions. It is used as a method of estimating fertility by calculating from the observed number of survivors of a given age x the expected number of births that occurred x years earlier. (In situations for which both fertility and mortality are known or can be reliably estimated, reverse survival can be used to estimate migration.)

ROBUSTNESS A characteristic of estimates that are not greatly affected by deviations from the assumptions on which the estimation procedure is based.

SEX RATIO AT BIRTH The number of male births for each female birth, or male births per 100 female births.

SINGULATE MEAN AGE AT MARRIAGE (SMAM) A measure of the mean age at first marriage, derived from a set of proportions of people single at different ages or in

different age groups, usually calculated separately for males and females.

STABLE POPULATION A population exposed for a long time to constant fertility and mortality rates, and closed to migration, establishes a fixed age distribution and constant growth rate characteristic of the vital rates. Such a population, with a constant age structure and constant rate of growth, is called a stable population.

STATIONARY POPULATION A stable population that has a zero growth rate, with constant numbers of births and deaths per year. Its age structure is determined by the mortality rates and is equivalent to the person-years-lived ($_nL_x$) column of a conventional life table.

SURVIVAL RATIO The probability of surviving between one age and another; often computed for age groups, in which case the ratios correspond to those of the person-years-lived function, $_nL_x$, of a life table. Also called survivorship probabilities.

SURVIVORSHIP PROBABILITIES See survival ratio.

SYNTHETIC PARITY The average parity calculated for a hypothetical cohort exposed indefinitely to a set of period age-specific fertility rates.

TOTAL FERTILITY RATE (TFR) The average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates; also referred to as total fertility. It is frequently used to compute the consequence of childbearing at the rates currently observed.

UNITED NATIONS AGE-SEX ACCURACY INDEX An index of age reporting accuracy that is based on deviations from the expected regularity of population size and sex ratio, age group by age group. The index is calculated as the sum of (1) the mean absolute deviation from 100 of the age ratios for males, (2) the mean absolute deviation from 100 of the age ratios for females, and (3) three times the mean of the absolute difference in reported sex ratios from one age group to the next. The United Nations defines age-sex data as "accurate," "inaccurate," or "highly inaccurate" depending on whether the index is less than 20, 20 to 40, or greater than 40.

WHIPPLE'S INDEX A measure of the quality of age reporting based on the extent of preference for a particular target digit or digits. The index

essentially compares the reported population at ages ending in the target digit or digits with the population expected on the assumption that population is a linear function of age. For a particular age range, often 23 to 62, the population with ages ending in the target digits is divided by one-tenth of the total population, the result then being multiplied by 100 and divided by the number of different target digits. A value of 100 indicates no preference for those digits, whereas values over 100 indicate positive preference for them.

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5.10

COMMITTEE ON
POPULATION AND DEMOGRAPHY Report No. 13

Fertility in Thailand: Trends, Differentials, and Proximate Determinants

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Panel on Fertility Determinants
Committee on Population and Demography
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PREFACE

The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, about the existence and extent of recent changes in fertility, and about the factors determining reductions in fertility.

In 1963, a Panel on Population Problems of the Committee on Science and Public Policy of the National Academy of Sciences published a report entitled The Growth of World Population. The appointment of that panel and the publication of its report were expressions of the concern then felt by scientists, as well as by other informed persons in many countries, about the implications of population trends. At that time, the most consequential trend was the pronounced and long-continued acceleration in the rate of increase of the population of the world, and especially of the population of the poorer countries. It was estimated in 1963 that the annual rate of increase of the global population had reached 2 percent, a rate that, if continued, would cause the total to double every 35 years. The disproportionate contribution of low-income areas to that acceleration was caused by rapid declines in mortality combined with high fertility that remained almost unchanged: the birth rate was nearly fixed or declined more modestly than the death rate.

Since the earlier report, however, the peak rate of growth in the world's population has apparently been passed. A dramatic decline in the birth rate in almost all the more developed countries has lowered their aggregate annual rate of increase to well below 1 percent, and the peak rate of increase has also apparently been passed in the less-developed parts of the world as a whole. A sharp decline in fertility in many low-income areas has more than offset the generally continued reduction in the death rate, although the rate of population increase remains high in almost all less-developed countries.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the Committee on Population and Demography was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks; it initiated work on the third task in October 1979 when the Panel on Fertility Determinants was established.

As of early 1982, 168 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee approaches the first task through careful assessment, by internal and external comparison, and through analysis, by application of the most reliable methods known, of all the data sources available. Each of the country studies therefore consists of the application of a range of methods to a number of data sets. Estimates of levels and recent trends judged to be the best that are feasible with available resources are then developed on the grounds of their consistency and plausibility and the robustness of the individual methods from which they were derived.

The committee's second task, refinement of methodology, is seen as a by-product of achieving the first. The application of particular methods to many different data sets from different countries and referring to different time periods will inevitably provide valuable information about the practical functioning of the methods themselves. Particular data sets might also require the development of new methodology or the refinement of existing techniques.

The third task of the committee, evaluation of factors determining birth rates, is the most difficult. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the committee and the Commission on Behavioral and Social Sciences and Education established the separately funded Panel on Fertility Determinants, which includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel.

This report is one of the panel's country studies. It has been prepared by John Knodel, professor of sociology, University of Michigan; Apichat Chamratrithirong, associate professor, Institute of Population and Social Research, Mahidol University, Bangkok; Nibhon Debavalya, director, Institute of Population Studies, Chulalongkorn University, Bangkok; and Napaporn Chayovan, staff member of the Institute of Population Studies, Chulalongkorn University and doctoral student at the University of Michigan during the time of this study. The panel is grateful to these scholars for their extensive efforts in analyzing data from many sources and preparing this report.

As indicated in the title, this report stresses analysis of the proximate determinants of fertility. The task of analyzing these determinants and the more fundamental social, cultural, and economic factors associated with levels and changes in fertility behavior is complicated and time-consuming, especially in a country like Thailand that has available many and varied data sets. Given the time and budget constraints within which the work on the current report took place, it was not possible to fully analyze fertility determinants in Thailand, and thus the primary focus is on the proximate determinants. Indeed the authors of this report are collaborating on a project in Thailand during late 1982 and 1983 that uses this report as a starting point for an assessment of social, cultural, and economic fertility determinants, under the International Research Awards Program on the Determinants of Fertility in Developing Countries, a Population Council program funded by AID.

The authors and panel would like to gratefully acknowledge the kind cooperation of the following persons who provided information or data included in this study: Tony Bennett, Pornchai Boodsayaskul, Peerasit Kamnuansilpa, Debhanom Muangman, Chintana Pejaranonda, Yawarat Porapakkham, Peter Smith, and Thavisak Svetsreni. We also acknowledge with thanks the research assistance of the following persons: Ratana Ariyavisitakul, Rapeepan Hoonpanich, Uraiwan Kanungsukkasem, Siriwan Siriboon, and Anchalee Wisuttimak. Helpful comments were received from reviewers, including members and staff of the panel and committee.

Several members of the panel and committee staff assisted in the preparation of this report. Appreciation is expressed to Solveig Padilla and Carole Turley, who helped type the text and tables, and to Rona Briere, who edited the report. Elaine McGarraugh applied her talents and sharp eyes to production editing details.

W. PARKER MAULDIN, Chair
Panel on Fertility Determinants

CHAPTER 1

INTRODUCTION

In the course of a remarkably short time, Thailand's population has experienced a major transformation in its reproductive behavior. The result has been a steady and substantial decline in fertility since the mid or late 1960s, with all indications pointing to its continuation for at least some time to come. Just a decade ago, few observers were aware that a reproductive revolution was under way in Thailand and probably even fewer would have predicted the magnitude of change that actually occurred during the 1970s.

The rapidity and pervasiveness that has characterized the decline in fertility makes Thailand an unusually interesting candidate for a case study of the determinants of reproductive behavior in a developing country. As the result of research presented at a workshop held in Thailand in 1978, a thorough summary documenting recent trends in Thai fertility up through 1975 has been prepared and published (National Research Council, 1980). Newly available data indicate that the decline in Thai fertility clearly evident prior to 1975 has continued since then (Knodel et al., 1980). The objective of the present study is to examine in some detail the intermediate variables or proximate determinants (Davis and Blake, 1956; Bongaarts, 1978) underlying the levels, differentials, and changes in fertility in Thailand during the recent past, as well as to update the trends in fertility since 1975 using more recent data than was available at the time of the 1978 workshop.

THE COUNTRY SETTING

Thailand is a tropical country in the Indo-Chinese peninsula of Southeast Asia with a total population expected to reach 50,000,000 by the early 1980s. It is bordered by Kampuchea and Laos on the east and northeast, by Burma on the west and northwest, and by Malaysia on the south. The landscape within this area includes tropical rain forest, agriculturally rich plains, and forest-clad hills and mountains. Thailand's population is predominantly rural and agrarian. Even in comparison with other developing countries, the proportion living in urban areas is unusually low and the percentage of the labor force engaged in agriculture is unusually high (see Table 1). It also compares poorly in terms of several "quality of life" indexes, including access to electricity and safe water, and physicians per population. Nevertheless, Thailand falls in the middle range for developing countries with respect to average income as measured by GNP per capita and is above average in terms of adult literacy, female participation in the labor force, and life expectancy. It should be noted, however, that although literacy is almost universal, the proportion of adults that have gone beyond four years of schooling (until recently the basic elementary educational level) is quite small; as of 1976, only 14 percent of the population aged 15 and over completed five or more years of schooling (Thailand, National Statistical Office, 1978).

During the twentieth century, Thailand experienced a relatively rapid rate of population growth. From a population estimated to be approximately 8 million at the time of the first census in 1911, Thailand grew to approximately 47 million by 1980. Much of this growth can be attributed to a rapid decline in mortality that preceded and then accompanied decline in fertility. One recent set of estimates indicates a fairly steady decline in the crude death rate since 1920, with the exception of the turbulent years during the Second World War (Economic and Social Commission for Asia and the Pacific, 1976). Expectation of life at birth probably increased by some two or three years between the mid-1960s and the mid-1970s, reaching about 58 years for males and 64 years for females by the end of the period. An important component of the improved mortality, since 1960 at least, has been a reduction in infant and child mortality (National Research Council, 1980). Recent trends in the former are summarized in Table 2 for the national as well

TABLE 1 Selected Social and Economic Indicators of Development: Thailand, East Asia and Pacific, and Developing Countries

Indicator	Thailand	East Asia and Pacific	All Developing Countries
GNP per capita (U.S. $), 1978	490	654	623
Percent annual growth in GDP per capita, 1970-77	4.0	5.7	3.2
Energy consumption per capita (kilograms of coal equivalent), 1977	327	466	507
Percent urban	14	30	29
Percent of labor force engaged in agriculture	77	51	49
Percent of total labor force that are women	47	35	25
Percent of dwellings with access to electricity	25	--	48
Radios per 1,000 population	131	92	64
Food consumption per capita (calories per day), 1977	1,929	2,231	2,290
Percent of population with access to safe water	22	22	42
Population per physician	8,370	3,509	4,638
Infant mortality rate (per 1,000 live births)	68	41	48
Life expectancy at birth	61.0	60.8	54.0
Percent of primary school enrollment rate	83	98	78
Percent of secondary school enrollment rate	26	39	23
Percent of adult literacy rate	82	84	52

Notes: Indicators not dated represent the most recent estimate as of 1980. Developing countries are defined in this table according to the World Bank definitions as used in the source and thus exclude centrally planned economies (including China) and capital-surplus oil-exporting countries.

Sources: World Bank (1980b, 1980c).

as the rural and urban populations. Direct estimates based on the dual-record system methodology of the two Surveys of Population Change agree reasonably well with indirect estimates based on the proportions dead among children ever born as reported in various sources. Both indicate moderate declines in infant mortality at the national level between the mid-1960s and mid-1970s. At the same time, they point to substantial and persistent differences in infant mortality between the rural and urban populations. The chance of a rural infant dying before reaching age 1 remains two to three times greater than for an infant of urban parents.

TABLE 2 Direct and Indirect Estimates of Infant Mortality by Place of Residence: Thailand

Type of Estimate and Source	Approximate Years to Which Estimate Applies	Infant Mortality per 1,000 Births		
		National	Rural	Urban
Direct Estimates				
First SPC	1964-65	84[a]	86	68[a]
Second SPC	1974-76	52	59	20
Indirect Estimates				
1970 Census	1966	70	74	31
Second SPC (Round 1)	1970	61	65	27
CPS1/NS (average)	1975	55[b]	59	26[b]
CPS2	1977	52	55	31

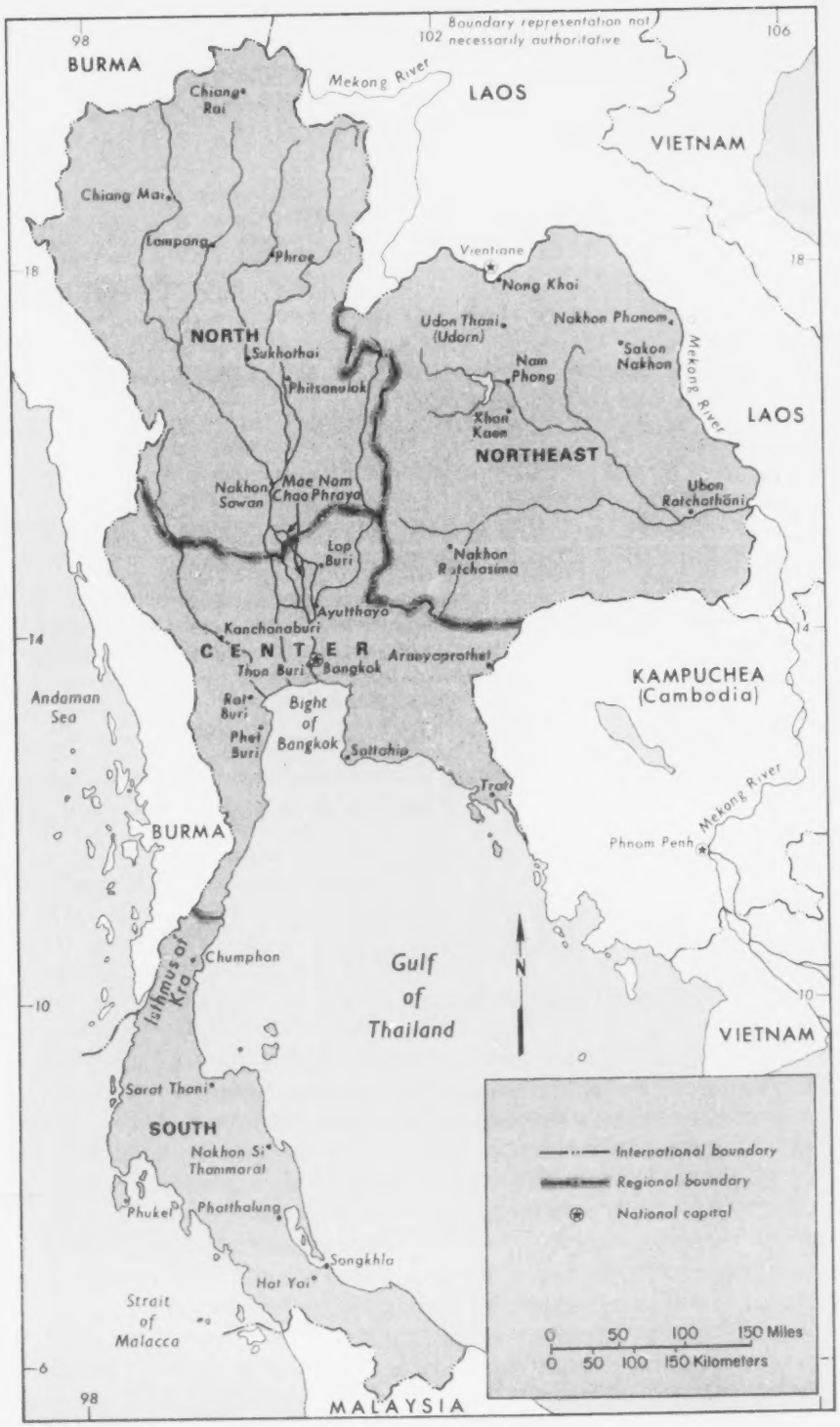
Notes: For full names of surveys, see Table 4. The indirect estimates of infant mortality were obtained from the North family of model life tables corresponding to indirect estimates of $_2q_0$, $_3q_0$, and $_5q_0$. For a description of the method of calculating the indirect estimates, see Knodel and Chamratrithirong (1978). Direct estimates are based on a dual-record methodology.

[a]Excluding Bangkok-Thonburi.
[b]Excluding provincial urban for CPS1.

Sources: Thailand, National Statistical Office (1978); Knodel and Chamratrithirong (1978); Kamnuansilpa and Chamratrithirong (1982); and additional calculations for the CPS1/NS results.

The patterns of rivers and mountains divide Thailand into four more or less natural regions: the mountainous north; the northeast, consisting primarily of the Korat Plateau; the central region, consisting primarily of the Chao Phya Basin; and the south, consisting of the long peninsular extension of Thailand south from the Chao Phya Basin to the Malaysian frontier (see Map). To varying extents, cultural and socioeconomic differences characterize these four regions. In the north, the Thai Yuan dialect is common; in the northeast, Thai Lao is prevalent; while in the south, the southern Thai dialect and Malay (especially among Moslems) are common. At the same time central Thai, the official language, is widely known throughout the country.

On most socioeconomic measures, the central region ranks highest, in part because of the inclusion of the



Source: Bunge (1981).

Bangkok metropolis within this region (see Table 3). The central plain is the heartland of rice cash cropping in a country where rice is the mainstay of the economy. Substantial parts of the Chao Phya Basin have benefited recently from a major irrigation project that has opened up wide expanses of land to the possibility of rice double-cropping.

The poorest region is the northeast, which, like the central region, contains about one third of the total Thai population. It is the driest region and suffers from periodic droughts combined with a lack of well-developed irrigation systems. Although lower primary education is close to universal in all regions, discrepancies still exist with respect to the percentage of children who continue their education beyond this level. Past discrepancies are evident in the regional differences in the percentage of the adult population that continued beyond the basic four years of education; the northeast ranks lowest in this respect.

The north is the second poorest region. Because of its mountainous terrain, rice farming in many areas is concentrated in narrow valleys and involves particularly intensive agricultural practices. Communally run small-scale water control systems are common and perhaps are part of the reason why social commitment to the structural organization of the valley community is generally judged to be greater in the north than elsewhere.

The smallest region in terms of both land area and population is the south, which tends to rank higher on most socioeconomic indexes than either the north or the northeast. It is the region of heaviest rainfall and is least dependent on rice as either a subsistence or export crop. Tin mining, rubber planting, and coastal fishing are important contributors to the local economy.

Despite these regional differences, the Thai population is relatively homogeneous in a number of important respects. Approximately 95 percent of the population are Buddhist, the large majority are ethnic Thais, and, although regional dialects are spoken, the official central Thai language is understood virtually everywhere. There is generally a sense of national identity reinforced by a widespread allegiance to the monarchy, which serves as an effective symbol of national unity.

Most non-Buddhists in Thailand adhere to Islam, which is practiced by about 4 percent of the population. The majority of Thai Moslems live in the south and are the majority or near majority in 4 of the 14 southern

TABLE 3 Distribution of Land Area and Population, and Selected Socioeconomic Indexes by Region: Thailand

Index	Source	Total	North	North-east	South	Central		
						All Central	Excluding Bangkok Metropolis	Bangkok Metropolis
Percent of land area	A	100	33	33	14	20	--	--
Percent of population, 1979[a]	B	100	21	33	13	33	22	11
Percent urban, 1979[a]	B	18	7	4	12	40	10	100
GDP per capita in 1978 (in U.S. $)[b]	C	377	272	156	360	707	566	997
Percent annual growth (in constant prices) in GDP, 1970-76	C	6.3	4.6	5.0	5.5	7.4	7.8	619
Percent of population above official poverty line, 1975-76	C	75	73	64	75	88	87	91
Percent literate among population, aged 10+, 1970	D	82	74	86	75	86	84	90
Percent of population aged 15+ with 5+ years of schooling, 1970	D	11	7	6	11	20	12	39
Age-standardized death rate, 1974-76	E	8.6	9.7	10.3	9.6	6.0[c]	6.4	4.8
Percent of households with radio, 1976	F	74	76	65	64	86	--	--
Percent of households with TV, 1976	F	11	4	3	5	28	--	--

[a]Based on registration data from the Ministry of Interior and thus not strictly comparable with data from the census or projections based on the census.
[b]20.1 baht = U.S. $1.00
[c]Weighted average calculated from Source E.

Sources: A Economic and Social Commission for Asia and the Pacific (ESCAP) (1976).
B Institute of Population Studies (1979).
C World Bank (1980b).
D 1970 Thai census.
E Thailand, National Statistical Office (1978).
F Thailand, National Economic and Social Development Board (1977).

provinces. Of the rural population in the southern region, 25 percent are Moslems according to the 1970 census.

The largest and economically most important ethnic minority in Thailand are the Chinese. While it is difficult to estimate with any precision the proportion represented by ethnic Chinese since there is no agreed-upon definition of Chinese ethnicity and considerable assimilation has taken place, various estimates suggest that they represent 5 to 10 percent of the total population. They are disproportionately concentrated in the urban areas and are predominantly involved in commercial activities. The second largest minority group are the ethnic Malays, who are concentrated in the south and represent perhaps as much as 4 percent of the national population. Other numerically smaller minorities include Indians and Pakistanis who are engaged largely in trade, Cambodians concentrated largely along the border areas near Kampuchea, Vietnamese living largely in the northeast, and a variety of hill tribes located mainly in the mountainous regions, especially in the northwest. In addition, a substantial number of temporary refugees--mainly from Laos and Kampuchea, although also from Vietnam--live in a number of specially established refugee camps.

During most of the present century, Thailand's official stance on population was predominantly pronatalist. As recently as 1956, the government offered bonuses for large families. As a result of a report by a World Bank economic mission in 1959 recommending that the government seriously consider the adverse effects of high population growth on economic development, the official position started to change. Pressures for a change were reinforced by the return of a number of Thai scholars who had studied demography and population matters abroad. A series of events during the 1960s led to the adoption by the Thai Cabinet in 1970 of a formal population policy aimed at slowing down population growth. An important part of this policy was to support voluntary family planning through an official government program. Despite several changes of government during the 1970s, the antinatalist policy remains intact. When a new constitution was drafted in 1974, it explicitly recognized the importance of population development for the nation's welfare. This recognition was reinstated in the present constitution drafted in 1978. The development of population policies since 1960 has been thoroughly reviewed in a recent study

published by the United Nations (1979). A detailed description of the history and current status of governmental and privately organized family planning activities has recently been completed by Bennett et al. (1982).

Administratively, the country is currently divided into 72 provinces (changwat) and the Bangkok metropolis. The provinces are further subdivided into districts (amphur), subdistricts (tambol), and villages (muban). Moreover, certain areas are designated as municipalities, which together with the Bangkok metropolis make up what is usually considered the urban population. Prior to its formation in 1971, the Bangkok metropolis consisted of two separate provinces, each of which contained certain areas classified as rural. For this reason, the definition of urban employed in a number of sample surveys utilized in the present study corresponds to the population living inside municipalities or the formerly urban sections of the Bangkok metropolis while the remaining population is defined as rural. In other surveys, the entire population of the Bangkok metropolis is treated as urban.

The usual practice of limiting the definition of the urban population outside the Bangkok metropolis to residents of politically defined municipalities has been criticized recently as being unrealistically narrow (Robinson and Wongbuddha, 1980). Indeed, a case can be made for making a finer distinction between rural and urban than is implied by a simple dichotomy, and several studies based on a 1-percent sample from the 1970 census have done so (Goldstein and Goldstein, 1978; Sermsri, 1980). In the present study, however, it is not possible to employ a scheme for distinguishing rural and urban different from that incorporated in the data sources used.

SOURCES OF DATA

The situation of Thailand is unusually favorable in comparison to most developing countries with respect to the availability of data for the study of fertility levels, trends, and determinants. These data are generally of reasonable quality, come from a variety of sources, and cover most of the period during which the fertility decline has taken place. Population censuses of varying demographic content have been held since 1911 with decennial censuses taking place in 1960, 1970, and 1980. A registration system for births and deaths has

been in existence since early in the century, although the data yielded by this system have been and continue to be incomplete. Most important for the study of determinants of fertility, however, have been a series of sample surveys conducted during the last decade and a half, which were designed specifically to study fertility or some closely related aspect of behavior. While in the present study we attempt to draw on information from any relevant source, our analysis is based largely on data from these sample surveys.

A list of the surveys, the abbreviation used to refer to them, the dates on which the field work took place, and a brief comment on the sample coverage are provided in Table 4. Some of these surveys are national in scope while others are regional or directed at specific subgroups of the population. A more detailed summary of the surveys upon which we draw most heavily is provided in the appendix. As we point out there, the samples vary in the extent to which they are comparable, even for those that roughly attempt to attain national coverage. Nevertheless, we believe the results of at least a number of these surveys are sufficiently comparable to enable us to both trace the trends in various determinants of fertility over time and to compare interrelationships at different stages of the fertility decline.

The surveys that will be used most intensively for these purposes are LS1, LS2, SOFT, CPS1, NS, AFPH, and CPS2. With the exception of AFPH, these surveys are more or less national in scope and in the case of AFPH, as discussed in the appendix, the 20 provinces from which the sample was drawn are sufficiently similar in a number of important respects to the total country that we feel justified in treating it essentially as a national sample as well.

The reader should be aware, however, of several of the more problematic aspects of making comparisons across these series of surveys. The most serious problem is making comparisons among the urban sections of the samples. This is true for two reasons. First, the number of urban respondents is quite small in the cases of SOFT, CPS1, NS, and, to a lesser extent, CPS2, since these surveys were intended to be self-weighting with respect to the rural and urban sectors of the population. Second, the universes from which the urban samples were drawn were not uniform with respect to the inclusion of provincial urban areas and the Bangkok metropolis and, in case of the latter, the surveys differ with respect to

whether all or only part of the area is treated as urban. In particular, the urban sample for CPSI was drawn exclusively from the Bangkok metropolis including the areas of the metropolis that are defined as rural in LS1, LS2, SOFT, and NS, while the AFPH urban sample excludes the Bangkok metropolis (since it is based on a universe of only 20 provinces). In cases where the rural and urban sectors of the sample were based on differing sample fractions, results for the total sample are appropriately weighted. Note should be made, however, that in the case of LS1 and LS2, there was a year's lag between the rural and urban phases. National estimates for LS2 are thus based on a combination of the 1969 rural sample with the 1970 urban sample, and LS2 on a combination of the 1972 rural sample with the 1973 urban sample.

Several conventions were followed in preparing the tables included in this study. When referring to the dates of surveys, hyphenated years will be reserved for those strictly representing coverage of a span of years, such as SPC2 for 1974-76. Years separated by a slash indicate either a survey that is primarily cross-sectional but whose field work spanned two calendar years such as CPS1 (1978/79) or combined results from two component cross-sectional surveys taking place in successive years such as LS1 (1969/70) and LS2 (1972/73). Many of the tables were derived from original tabulations not published elsewhere. In such cases, the source is simply indicated as the survey itself. Only when tables or parts of tables were derived from previous publications or manuscripts in process are references made to a bibliographical source.

PLAN OF ANALYSIS

In their seminal article on intermediate fertility variables, Davis and Blake (1956) made a major contribution to the conceptualization of fertility determinants by specifying variables through which and only through which all other fertility determinants--be they socioeconomic, cultural, or environmental--must operate. These intermediate variables are the only ones that directly affect fertility and thus can be considered the proximate determinants. Recent work by Bongaarts (1978) provides a simple analytic accounting framework in which a change in fertility can be related to changes in

TABLE 4 Selected Surveys Providing Information on Fertility or Fertility Determinants: Thailand

Abbreviation	Full Name	Date of Major Fieldwork	Sample Coverage
SPC1	Survey of Population Change, 1964-67	Mid-1964 to mid-1967 (usually only results for first years cited)	National except for exclusion of Bangkok-Thonburi
LS1	Longitudinal Study of Social, Economic, and Demographic Change - Round 1	Rural - April/May 1969 Urban - April/May 1973	National except for exclusion of sensitive areas and predominantly Muslim provinces in south
LS2	Longitudinal Study of Social, Economic, and Demographic Change - Round 2	Rural - April/May 1972 Urban - April/May 1973	National except for exclusion of sensitive areas and predominantly Muslim provinces in south
SPC2	Survey of Population Change, 1974-76	Mid-1974 to mid-1976	National
SOFT	Survey of Fertility in Thailand (part of WFS)	April/May 1975	National
WRPS	Westinghouse Rural Population Survey	1975	National rural sample with various exclusions
VOC	Value of Children Study	April/May 1976	National
FPHH	Family Planning Health and Hygiene Baseline Study	July/August 1977	Northeast region

NTFS	Northern Thai Fertility Survey	November 1976/January 1977	Rural sample of Chaing Mai and Chiang Rai provinces
CPS1[a]	Contraceptive Prevalence Survey - Round 1	December 1978/January 1979	National except for exclusion of provincial urban places
AMS	Asian Marriage Survey (Thailand)	December 1978/May 1979	Bangkok general, Bangkok slum, (Klong Toey) and a semi-rural area in Central region (Ang Thong)
NS	National Study of Family Planning Practices, Fertility, and Mortality	April/May 1979	National except for exclusion of sensitive areas and predominantly Muslim provinces in south
AFPH	Accelerated Family Planning and Health Project Baseline Survey	October/November 1979	The 20 provinces selected for inclusion in the Accelerated Family Planning and Health Project
NES	Northeast Survey	April/June 1980	Rural northeast region
CPS2	Contraceptive Prevalence Survey - Round 2	April/June 1981	National

Note: The analysis depends most heavily on LS1, LS2, SOFT, CPS2, NS, AFPH, and CPS1; more detailed information on each is provided in the Appendix.

[a]In this report, CPS1 is occasionally referred to as CPS.

the proximate determinants. Empirically, Bongaarts (1980b) has found that four proximate determinants--marriage pattern, contraceptive use and effectiveness, prevalence of induced abortion, and duration of lactational infecundability--account for nearly all the variations in fertility levels among populations. The main focus of the present study is on the proximate determinants, including, but not limited to, the four Bongaarts found to be of such importance. We also apply his accounting scheme to our results for Thailand. Although there are considerable differences in both the amount and quality of information available for Thailand on the different proximate determinants, at least some information is available for most. Before turning to the proximate determinants, however, we review in Chapter 2 recent trends in current fertility, including trends in the open birth interval and percent of women reporting themselves as currently pregnant. In addition, we discuss the relative contribution of age and marital structure to changes in the crude birth rate, the changing age structure of marital fertility, and trends in completed and expected family size.

Bongaarts (1978) has grouped proximate fertility determinants into three broad categories, namely, factors relating to exposure, to natural marital fertility, and to deliberate marital fertility control. We divide our discussion of proximate determinants along these lines. In Chapter 3 we explore family formation and dissolution or, in Bongaarts's terminology, exposure factors. In Chapter 4, we cover a variety of natural marital fertility factors: specifically the limits of the childbearing span as determined by age at menarche, menopause, and last birth; primary sterility; coital frequency; and lactational infecundability. Deliberate marital fertility control is treated in Chapter 5, which deals specifically with contraception and abortion as well as examining the extent to which adoption practices serve to limit family size. Based on the accounting scheme proposed by Bongaarts, an attempt is made in Chapter 6 to assess the contribution of several key proximate determinants to the recent levels and changes in Thai fertility.

In Chapter 7 we turn to a limited discussion of attitudes related to reproduction that we believe are particularly important for understanding recent and future fertility trends. Our focus is on trends in desired family size, preferences for the sex composition

of children, and attitudes toward deliberate birth control, the major proximate variable responsible for the fertility decline. Chapter 8 consists of a largely descriptive presentation of differentials in several aspects of reproductive behavior and attitudes by education, income, and religion. To a limited extent, fertility differentials are related to differentials in several key proximate determinants. Finally, Chapter 9 provides a summary and some concluding comments.

CHAPTER 2

RECENT TRENDS IN FERTILITY AND FAMILY SIZE

Deficiencies in the vital registration system and the absence of fertility surveys prior to the mid-1960s make it difficult to pinpoint with any certainty the precise year in which fertility rates turned downward in Thailand. While an occasional analysis suggests that the crude birth rate may have started a protracted decline in the mid-1950s (Vallin, 1976), the bulk of the evidence suggests that there was little or no momentum in the fertility decline at the national level prior to the 1960s. According to the extensive study of recent fertility trends by the National Research Council (1980), the level of fertility as measured by the total fertility rate was in the range of 6.3 to 6.6 births per woman in the early 1960s and began to decline fairly sharply in the mid-1960s reaching a level of 5.4 to 5.8 in 1970, and 4.5 to 4.9 by 1975. Several sources of estimates indicate an acceleration of fertility decline in the early 1970s, although the evidence on this is not conclusive. The Panel concluded that urban fertility was probably already declining by 1960 and continued to decline thereafter, while rural fertility probably remained relatively constant until the second half of the 1960s and then began a rapid decline.

Based on the estimates of total fertility and child and adult mortality, the Panel estimated the crude birth and death rates and thereby derived a rate of natural increase for the Thai population. The ranges of total fertility cited above correspond to crude birth rates of 43 to 46 births per 1,000 population for the early 1960s, 36 to 38 by 1970, and 32 to 36 by 1975. More recent evidence indicates a continuation of the fertility decline since 1975. Thus, by 1980 the rate of natural increase was probably around 2 percent, down from over 3

percent in the early 1960s and the 2.3 to 2.6 percent in 1975 estimated by the Panel.

NATIONAL, RURAL-URBAN, AND REGIONAL FERTILITY TRENDS

First in the mid-1960s and then again in the mid-1970s, the National Statistical Office attempted to estimate fertility and mortality parameters and the completeness of vital registration through a dual-record system approach. These efforts, called the Surveys of Population Change (SPC1 and SPC2), provide estimates of total fertility. In addition, total fertility can be estimated from a series of single, cross-sectional national sample surveys based on retrospectively reported births to married women. In addition to the differences in the methodologies involved, these estimates are based on far smaller samples than either Survey of Population Change. In addition, they are sensitive to the marital structure used to convert the age-specific marital fertility rates into age-specific rates. Nevertheless, the estimates from these two different types of sources fit together reasonably well, at least for the period between the mid-1960s and mid-1970s (see Table 5 and Figure 1).[1] A comparison of SPC1 and SPC2 suggests a 22-percent decline in total fertility between the mid-1960s and the mid-1970s, while the series of single surveys suggests a decline in total fertility in the neighborhood of 40 percent during the decade or so following the end of the 1960s. The most recent survey (CPS2) indicates a somewhat higher total fertility rate than the two immediately previous surveys (NS and CPS2) taken about two years earlier. While a genuine increase in fertility cannot be ruled out conclusively, sampling error and differences in the questions and approaches used to derive these rates may well account for the apparent rise (for example, Kamnuansilpa et al., 1982). Evidence on the percent pregnant points to a decrease rather than an increase in fertility in the intervening period (see below). In addition, the prevalence of contraceptive use increased (see Chapter 5).

Since the collection of fertility data was restricted to married women in the single surveys (with the exception of CPS1), they serve as a more appropriate basis for estimating marital fertility than total fertility. A convenient summary measure of marital fertility is provided by an age-standardized index

TABLE 5 Total Fertility Rates and Age-Standardized Marital Fertility (I_g'): Thailand

Year of Survey	Survey	Total Fertility Rate, National: Dual-Record System	Total Fertility Rate, National: Single Survey	Marital Fertility (I_g') from Single Surveys: National	Rural	Urban
1964-65	SPC1	6.30[a]				
1969/70	LS1		6.12	.72	.77	.53
1972/73	LS2		5.30	.64	.67	.51
1975	SOFT		4.52[b]	.57	.58	.50
1974-76	SPC2	4.90				
1978/79	CPS1		3.77[c]	.44[c]	.44	.45[d]
1979	NS		3.38	.44	.44	.40
1981	CPS2		3.91	.46	.46	.46

Notes: Fertility rates for the single surveys refer to births during the 12 months prior to the survey. The total fertility rate for LS1 was derived by multiplying age-specific marital fertility by proportions currently married as interpolated between the 1960 and 1970 censuses after adjusting the 1960 census for one-half year age misstatement; total fertility rates for LS2, SOFT, and NS were derived by multiplying age-specific marital fertility by the proportions currently married estimated by interpolation between the 1970 census and the preliminary 1-percent sample of the 1980 census.

[a]Excludes Bangkok-Thonburi.
[b]This estimate differs from published estimates reported in Knodel and Piampiti (1978) because it is based on births 12 months prior to the survey, (rather than births during the calendar year 1974) and because it incorporates marital structure as interpolated between the 1970 and 1980 censuses.
[c]Excludes provincial urban.
[d]Bangkok metropolitan area.

Sources: Thailand, National Statistical Office (1978); Kamnuansilpa and Chamratrithirong (1982) (plus personal communications from Anne Cross); Kamnuansilpa et al. (1982); Knodel et al. (1980).

labeled Ig'. This measure expresses the level of observed fertility as a ratio to the highest marital fertility on reliable record (that of the Hutterite population of North America) after directly standardizing for age.[2] The results from this series of surveys clearly indicate a sharp fall in marital fertility during the period under observation. See the last three columns of Table 5 and Figure 2. The CPS2 data seem to suggest a halt to the decline and even a slight increase in marital fertility when compared to the immediately prior surveys; however, as discussed above, this may be more an artifact of the data and sampling error than a genuine change in

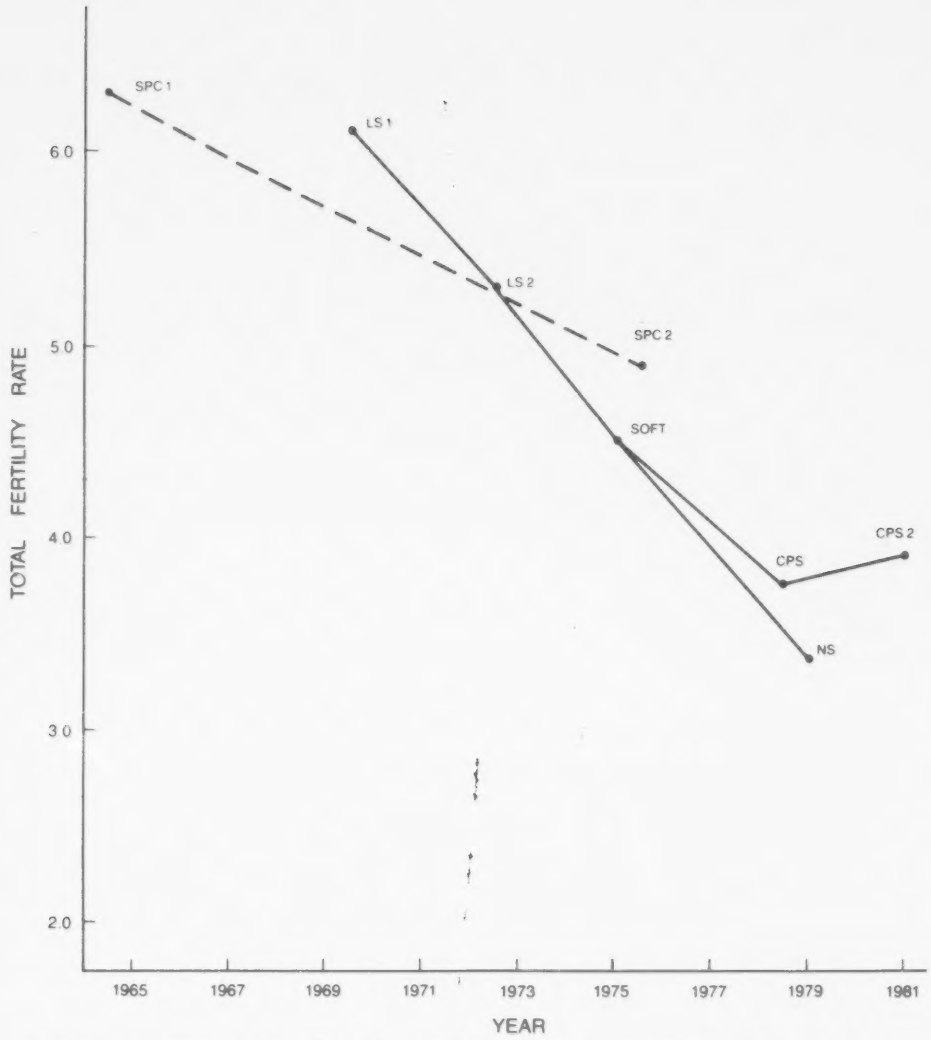


FIGURE 1 Total Fertility Rate from Surveys, 1964-65 to 1981: Thailand

Note: See notes to Table 5.

trend. Even if the higher estimates of CPS2 are accepted, Ig' at the national level has declined by almost 40 percent since the late 1960s, thus representing one of the most rapid fertility reductions in the developing world. The decline in rural marital fertility is even larger than for the country as a whole with the result that the pronounced urban-rural differential evident at the end of the 1960s had been eliminated by the early 1980s.

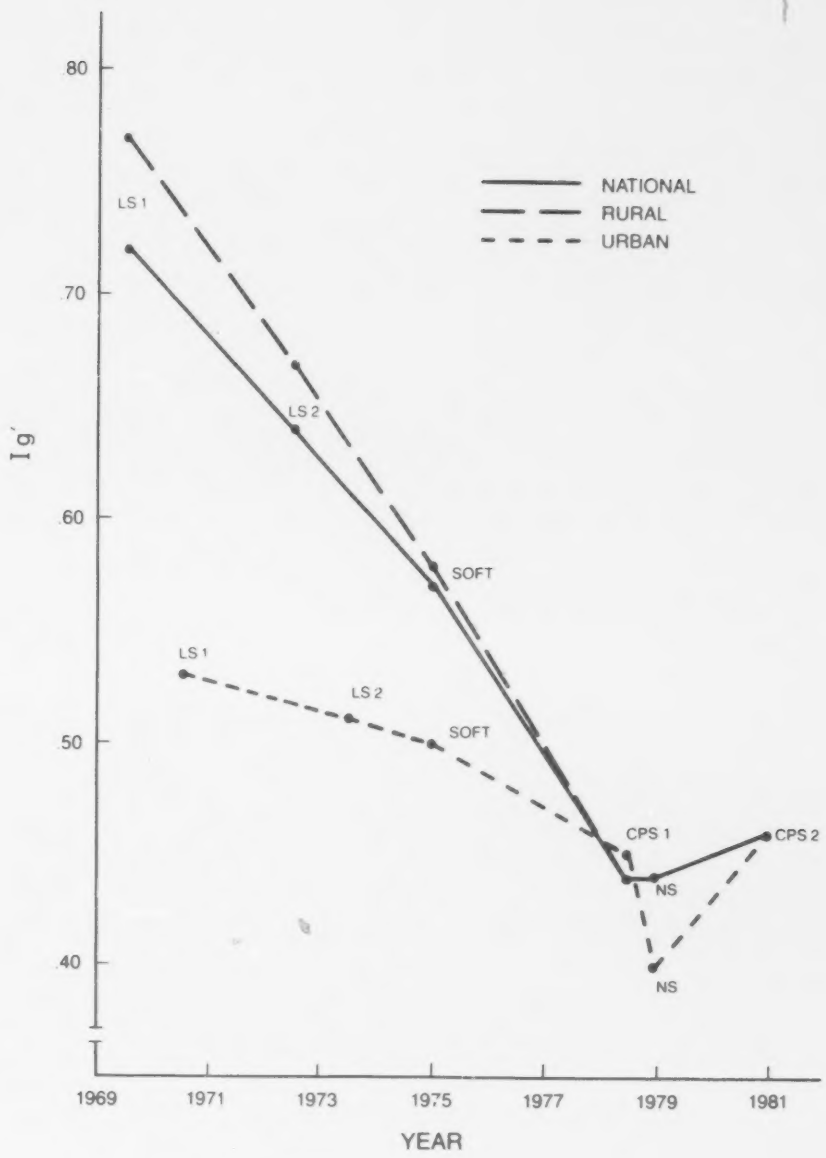


FIGURE 2 Age-Standardized Marital Fertility (I_g') from Selected Surveys, 1969-70 to 1981: Thailand

Note: See notes to Table 5.

According to the National Research Council (1980) report, the national fertility decline up to 1975 was largely a result of rapid reductions in the central and northern regions of Thailand with much less change evident in the northeastern and southern regions. A comparison of the first and second Surveys of Population Change clearly indicates such a regional difference in fertility decline between the mid-1960s and mid-1970s (see Table 6). More recent evidence, however, indicates that the situation has changed since 1975 and that a fertility decline is now clearly under way in the northeast. The evidence for the south is mixed with respect to recent fertility change, undoubtedly due to the small proportion of any self-weighting national sample that comes from this region. Evidence for the south from CPS1 and NS, but not CPS2, suggests that fertility decline there lags behind the rest of the country. The regional results from the national single surveys must be considered only suggestive, since in most cases the samples were not designed to yield regional

TABLE 6 Total Fertility and Age-Standardized Marital Fertility (I_g') by Region: Thailand

	Central, Excluding Bangkok	North	North-east	South
I. Total fertility rates from Survey of Population Change				
1964-65	5.90	6.47	6.61	6.02
1974-76	4.11	3.74	6.25	6.12
	Rural Only			
II. Marital fertility one year prior to surveys from single surveys (I_g')				
1975 (SOFT)	.54	.43	.68	.66
1977 (FPHH)[b]	--	--	.62[a]	--
1978/79 (CPS1)	.46	.33	.45	.58
1979 (NS)	.45	.32	.44	.72
1980[c] (NES)[b]	--	--	.48	--
1981 (CPS2)	.47	.37	.49	.49

[a]Includes provincial urban.
[b]Surveys conducted in northeast only.
[c]Refers to births from January to December 1979.

Sources: Thailand, National Statistical Office (1978); Knodel et al. (1980); and unpublished tabulations.

estimates. In the case of the northeast, however, the recent decline in fertility is further confirmed by two large regional surveys (FPHH and NES). The rapid process and advanced stage of fertility reduction in the central and north regions have been documented in several other sources as well (see National Research Council, 1980; Shevasunt and Hogan, 1979; Pardthaisong, 1978). Calculations based on the Northern Thai Fertility Study, which refers to the rural population of two provinces in the north, indicates that Ig' declined from 0.51 in 1968-72 to 0.40 in 1973-76. This latter figure falls between the results indicated for the north from SOFT and CPS or NS.[3]

THE IMPACT OF AGE AND MARITAL STRUCTURE ON THE BIRTH RATE

In some countries, changes in the age structure have had a measurable effect on facilitating or hindering fertility decline when measured in terms of the crude birth rate or other indexes sensitive to age distribution. Moreover, in countries where most fertility is legitimate, changes in the marital status composition of the population can have a considerable impact on overall fertility, above and beyond the impact of changes occurring in marital fertility. Thus, in trying to account for changes in the overall level of fertility, marital status is an important factor to take into account. In the case of Thailand, changes in the age and marital status distributions do not appear to be of great importance during the period of fertility decline, although inconsistencies in the evidence regarding changes in nuptiality patterns make it difficult to estimate the contribution of the latter with much precision. The proportion of the population that comprises women in the reproductive ages remained relatively unchanged between 1960 and 1970 but shows evidence of increasing over the following decade, especially since 1976, as would be expected as a result of the earlier sharp decline in fertility (see Table 7). The age distribution of women <u>within</u> the reproductive span has remained relatively stable during the entire two decades between 1960 and 1980 and is not expected to be influenced by recent fertility trends for another ten years. Thus it seems safe to conclude that changes in fertility measures that are sensitive to age distribution have been largely unaffected by shifts in age structure

TABLE 7 Age Distribution of Women in the Reproductive Ages Expressed as Percent of Total Population and as Percent of All Women Aged 15-49: Thailand

Age Group	Percent of Total Population					Percent of Women 15-49				
	Census 1960	SPC1 1965	Census 1970	SPC2 1976	Census 1980[a]	Census 1960	SPC1 1965	Census 1970	SPC2 1976	Census 1980[b]
15-19	4.7	5.0	5.5	5.8	6.0	20.3	22.2	24.2	24.1	23.4
20-24	4.6	4.0	4.0	4.5	5.1	19.8	18.0	17.5	19.0	19.8
25-29	4.0	3.7	3.3	3.5	4.1	17.2	16.3	14.7	14.8	15.9
30-34	3.3	3.2	3.1	2.8	3.1	14.3	14.2	13.8	11.9	12.2
35-39	2.6	2.7	2.8	2.8	2.7	11.2	12.0	12.3	11.7	10.4
40-44	2.2	2.1	2.2	2.4	2.5	9.3	9.3	9.8	10.1	9.8
45-49	1.8	1.8	1.7	2.0	2.2	7.9	7.9	7.7	8.3	8.4
15-49	23.2	22.4	22.7	23.9	25.7	100.0	100.0	100.0	100.0	100.0

Note: Persons of unknown age have been proportionately distributed.

[a]Based on 1-percent sample assuming sex ratio of total population is the same as reported in SPC2.
[b]Based on 1-percent sample.

Sources: 1980 census from unpublished preliminary tabulations of the 1-percent sample; all others calculated from official published reports.

during the period between 1960 and the mid-1970s, but that the influence of such changes is beginning to and will continue to be of some importance in the near future.

Data on the proportions single as recorded from 1947 on in the censuses and in several surveys are summarized in Table 8 and Figure 3 presents the trend 1960-80 for two age groups, 20-24 and 45-49. Age was determined in a somewhat different manner in the 1947 and 1960 censuses compared to the later censuses and surveys. Thus, the 1947 census is directly comparable with the 1960 census as reported, but neither is directly comparable with the later sources. For this reason, results from the 1960

TABLE 8 Proportions Single and Singulate Mean Age at Marriage (SMAM) by Sex and Age Group from Selected Sources: Thailand

		Census 1960					
Sex and Age Group	Census 1947	Reported Ages	Adjusted Ages	Census 1970	SOFT 1975	SPC2 1975	Census 1980[a]
Females							
15-19	.806	.862	.830	.810	.846	.786	.835
20-24	.300	.387	.352	.379	.415	.359	.428
25-29	.109	.141	.126	.156	.192	.156	.206
30-34	.057	.067	.062	.081	.101	.081	.114
35-39	.040	.042	.040	.053	.064	.048	.079
40-44	.032	.031	.030	.039	.039	.032	.054
45-49	.029	.026	.026	.030	.033	.015	.044
SMAM	21.06	22.10	21.64	21.97	22.46	21.96	22.68
Males							
15-19	.967	.976	.959	.963	.969	.957	.960
20-24	.606	.699	.663	.651	.639	.623	.646
25-29	.242	.270	.242	.249	.259	.257	.266
30-34	.104	.098	.088	.106	.081	.097	.115
35-39	.069	.053	.050	.058	.059	.062	.060
40-44	.050	.037	.036	.038	.028	.040	.042
45-49	.044	.032	.032	.032	.024	.033	.035
SMAM	24.32	25.02	24.52	24.67	24.77	24.42	24.83

Note: Persons of unknown marital status have been proportionately distributed except for male priests who are treated as single.

[a]Based on 1-percent sample.

Sources: National Research Council (1980); United Nations (1956); and unpublished preliminary tabulations of the 1-percent 1980 census sample.

census are presented both as reported and in an adjusted form which increases their comparability to later sources.[4] A comparison of the 1947 and unadjusted 1960 census results indicates that a moderate increase took place in the proportion single among women and men in the younger reproductive ages. This may have contributed to some reduction in the crude birth rate in the 1950s, although, as indicated above, estimates of fertility prior to 1960 are tenuous. Since 1960, most, but not all, evidence points to a continuation of the trend toward increasing proportions single, especially among women. A moderate continuation of the increase in proportion single among women at most ages, but particularly in the twenties, is indicated by a comparison of the 1960 (adjusted), 1970, and preliminary 1980 census results. In contrast, evidence from SPC2 suggests a relative lack of change. Results from SOFT for 1975, however, generally show proportions single among women that are consistently higher than the 1970 census and only slightly below those in the 1980 census. Proportions single among males show less variation across different sources than for women and appear to have remained relatively constant between 1960 and 1980; there is only a slight tendency toward increase evident at ages 25 and above.

The singulate mean age at marriage, an estimate of the age at first marriage derived from the proportions single by age, registers a 0.8 year increase for women and a 0.3 year increase for men between the adjusted 1960 census results and the preliminary 1980 results (see Table 8 and Figure 3). Results from SPC2, however, do not fit into this trend and suggest rather that the mean age at marriage may not have risen so much or perhaps not at all. In contrast, the results for women from SOFT indicate an age at marriage almost as high as that implied by the 1980 census preliminary results. If more weight is given the census results, the evidence points to a modest trend toward increasing proportions single and rising age at first marriage since 1960, especially for women. The contradictory evidence provided by SPC2, indicating little trend in proportions single, cannot be dismissed conclusively, however, given the large sample size on which it is based and the apparent problems associated with the 1980 census.[5] Moreover, analyses presented in the next chapter based on retrospective reports of age at first marriage from several surveys also point to little change.

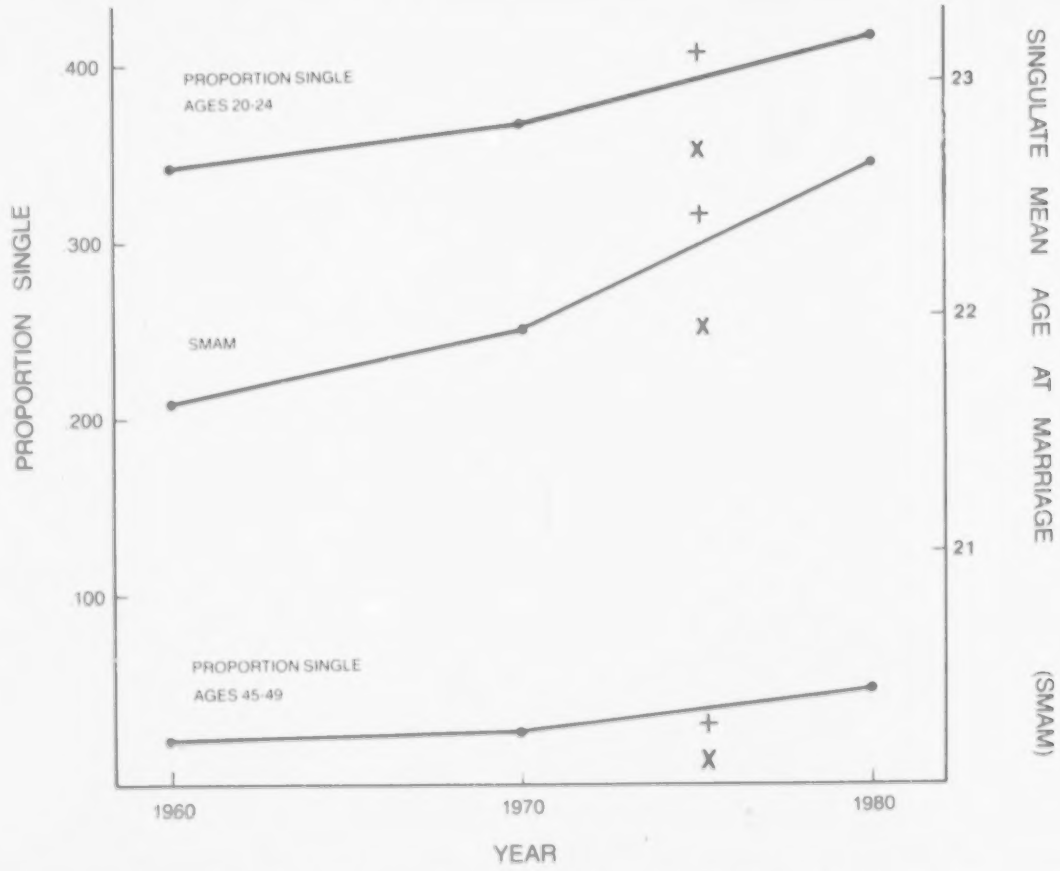


FIGURE 3 Proportions Single in Age Groups 20-24 and 45-49 and Singulate Mean Age at Marriage from Censuses and Two Surveys, 1960-80: Thailand

Sources: • 1960, 1970, 1980 censuses; + 1975 SOFT; X 1975 SPC 2.

In Thailand, there is little difference between men and women in their age at first marriage. Judging from the singulate mean age at marriage, men are only about two and one-half years older than women when they marry for the first time. This is a small difference compared to many other developing countries, where the mean age difference between spouses can be as large as eight years, as in the case of Bangladesh (Durch, 1980; Smith, 1980). In natural fertility populations, age differences between spouses can exert a significant influence on marital fertility levels, with the marital fertility of women at any given age generally being inversely related to the age of their husbands (Knodel, 1982). In the case of Thailand, however, where birth control within marriage has become extensive, the age difference between spouses is unlikely to be an important factor in explaining fertility levels.

So far, our discussion of fertility trends has been in terms of the total fertility rate or the age-standardized index of marital fertility. The two Surveys of Population Change have also yielded estimates of the crude birth rate. According to these estimates, the crude birth rate declined from 42.2 in 1964-65 to 35.6 in 1974-76, a decline of about 16 percent during the intervening decade. Using a statistical technique reported by Cho and Retherford (1973), it is possible to decompose his change in the crude birth rate into the amount due to changes in (1) age-sex structure; (2) marital structure (i.e., percent married in each age group); and (3) age-specific marital fertility rates. Since not all the data required for this decomposition were available directly from the reports of the Surveys of Population Change, data from several sources were combined for this purpose.[6] As already pointed out, however, SPC2 indicates lower proportions single for women than found by SOFT or implicit in the trend between the 1970 and 1980 censuses. If the SPC2 proportions single (and thus proportions married) are unrepresentative, results of the decomposition exercise will be misleading and will not reflect the contribution of increased delay of marriage to the decline in the birth rate. We have therefore made a second set of calculations assuming that the proportions currently married in 1975 (the midpoint of SPC2) were not as recorded in SPC2 itself but rather equal to the average value of those indicated by the 1970 and 1980 censuses (since SPC2 took place midway between the censuses).[7] Combining the

alternative proportions currently married with the observed age structure and fertility rates would imply that the crude birth rate for 1974-76 had fallen somewhat more than actually observed, to 33.1 per 1,000 population.[8]

The specific results are as follows:

Percent Contribution with 1975 Marital Structure

Contribution from Changes	As Observed in SPC1	As Implied by 1970 and 1980 Censuses
Age-sex structure	+19	+15
Marital structure	+15	-14
Age-specific marital fertility	-134	-101
Total	-100	-100

The results indicate that changes in both the age-sex structure and the marital structure of the population are relatively small compared to changes in marital fertility. If marital structure in 1975 is taken to be as recorded in SPC2, then both age structure and marital structure changed in a manner that would have led to an increase in the crude birth rate between 1965 and 1975 had marital fertility remained constant. Thus the decline in marital fertility not only is responsible for the entire decline in crude birth rate, but it also compensated for changes in the other two factors. Since the contribution of these three factors must add up to 100 percent according to the technique employed and since the changes in the age-sex structure and marital structure would have led to an increase in the crude birth rate, the change in marital fertility, given the marital structure recorded in SPC2, is thus accountable for over 100 percent of the observed decline in crude birth rate. If, in contrast, the 1975 marital status is assumed to have changed as implied by the trend toward increased proportions single, indicated by the 1970 and preliminary 1980 census results, changes in marital structure would have contributed to rather than detracted from the decline in the crude birth rate. The contribution of age-sex structure, however, is still in the opposite direction and of about equal magnitude. According to these calculations, had age,

sex, and marital status distributions remained unchanged between 1965 and 1975, the change in the crude birth rate would have been about the same as actually observed. As a result, the contribution of marital fertility decline is estimated as accounting for almost exactly 100 percent of the change. The main point made by both sets of calculations is that the contribution of changes in marital and age-sex structure to changes in the crude birth rate were relatively minor compared to the reduction in marital fertility.

THE AGE STRUCTURE OF MARITAL FERTILITY

Populations in a state of natural fertility--i.e., where no deliberate attempts are made to limit family size within marriage--can vary substantially in their level of marital fertility. However, despite such variations, it is now well established that they share a relatively similar age pattern of marital fertility, which is determined primarily by the decline of fecundity with age (Henry, 1961; Knodel, 1982). In natural fertility populations, fecundity and thus fertility remain high during much of the woman's reproductive span and it is only with the rapid decline in the ability to bear children during the later reproductive ages that fertility also declines precipitously with increasing age. In contrast, in populations where family size limitation is common, age-specific marital fertility rates tend to show a more rapid decline at earlier ages and to be particularly low at older ages. The reason for this is that most married couples who wish to limit the number of children they have typically concentrate their childbearing in the earlier part of the wife's potentially fertile period. Since the proportion of couples reaching their desired family size increases with age, so do efforts to prevent further births. The result is to lower fertility disproportionately at the later reproductive ages compared to a natural fertility population. One implication of this contrast is that as a population moves away from a state of natural fertility to one in which family limitation is widely and intensively practiced, marital fertility typically declines disproportionately more among older women (Knodel, 1977).

Since a series of national sample surveys in Thailand collected partial or complete birth history data from married female respondents, it is possible to derive

TABLE 9 Age-Specific Marital Fertility During Year Prior to Survey, Coale-Trussell Indexes of Fertility Control (m) and Level (M), and Mean Square Error (MSE) of Estimates of m and M, by Place of Residence: Thailand

Place of Residence and Survey	Year of Survey	Age of Women							m	M	MSE
		15-19	20-24	25-29	30-34	35-39	40-44	45-49			
Rural											
LS1	1969	419	457	374	292	252	198	39	-.08	.85	.028
LS2	1972	417	402	376	211	209	160	19	.03	.77	.048
SOFT	1975	475	371	268	213	181	101	20	.18	.70	.011
CPS1	1978/79	318	327	218	134	124	53	33	.52	.61	.019
NS	1979	350	332	206	161	118	51	8	.55	.63	.008
CPS2	1981	321	350	255	156	96	59	8	.61	.69	.022
Urban											
LS1	1970	360	380	306	174	114	82	22	.46	.75	.037
LS2	1973	483	366	293	174	96	28	13	1.10	.68	.006
SOFT	1975	(549)	396	302	110	51	40	18	1.13	.78	.094
CPS1[a]	1978/79	(382)	293	302	211	80	0	(0)	.90	.77	.040
NS	1979	(286)	259	239	162	98	15	0	1.20	.73	.085
CPS2	1981	(389)	357	256	174	74	32	0	1.05	.79	.008
Total											
LS1	1969/70	412	442	361	267	228	180	36	-.02	.88	.031
LS2	1972/73	422	397	362	205	190	144	18	.10	.77	.045
SOFT	1975	481	375	273	199	164	93	20	.27	.71	.014
CPS1[b]	1978/79	309	320	234	148	116	45	27	.64	.66	.005
NS	1979	343	320	212	161	114	44	7	.63	.64	.004
CPS2	1981	330	351	255	159	92	55	7	.67	.70	.019

Notes: Marital fertility rates are expressed per 1,000 currently married women. Rates in parentheses are based on denominators of fewer than 50 woman years per five-year age group. The Coale-Trussell indexes are based on the age groups 20-24 through 40-44.

[a]Bangkok metropolitan area.
[b]Excluding provincial urban.

Source: CPS2 from Kamnuansilpa and Chamratrithirong (1982).

age-specific marital fertility rates based on the number of births that are reported to have occurred in the year prior to each survey.[9] The resulting series permits an examination of the age pattern of fertility and how it evolved during the course of the recent fertility decline (see Table 9). The expected change in the age pattern of fertility is evident from this series of marital fertility rates. For example, a comparison for the total population of marital fertility rates derived from CPS2, the most recent survey, with those from LS1, which refer to a period approximately a decade earlier, indicate that the marital fertility rate among women aged 20-24 declined by only 21 percent compared to a decline of 69 percent among women aged 40-44.

Coale and Trussell (1974) have developed two indexes that can be used to characterize any given marital fertility schedule. One index, designated m, indicates the extent to which the given schedule departs from the age pattern of a standard natural marital fertility schedule. This index can be referred to as the Coale-Trussell index of fertility control, since the age pattern of marital fertility, as discussed above, reflects the extent of family limitation practiced in the population. The m index is constructed so it will equal zero if the shape of the observed fertility schedule is identical to that of the standard natural fertility schedule. The faster marital fertility falls with age the higher the value of m, which can reach values above 2 in populations where family limitation is extensive. Negative values of m will result if marital fertility falls more slowly with age than in the standard. Another index, designated M, represents a scale factor intended to indicate the underlying level of natural fertility in the observed population relative to the standard marital fertililty schedule and can be referred to as the Coale-Trussell index of fertility level. The M index is designed to equal 1 in situations where the underlying level of natural fertility is the same as that incorporated in the standard schedule. For various reasons, the M index tends to underestimate the underlying level of natural fertility once control becomes common, but it can be a useful measure for comparing the underlying level of natural marital fertility for populations with modest levels of family limitation.

Coale and Trussell (1978) have proposed a procedure for estimating the m and M indexes through ordinary least squares methods. One advantage of this procedure is that

it yields a value for the mean square error of the regression, which can serve as an indication of how well the observed age pattern of marital fertility fits the fertility model on which the Coale-Trussell indexes are based.

In the case of Thailand, based on the age-specific marital fertility rates calculated from the series of surveys included in Table 9, the m index for the country as a whole rises from slightly below zero to close to 0.7 during the period from the end of the 1960s to the start of the 1980s. Thus, marital fertility was transformed from an age pattern consistent with natural fertility to one indicative of moderate fertility control. In addition, the value of the m index is substantially higher for the urban population at every survey than for the rural population. The urban value of the m index for LS1, the earliest survey, already reflects an age pattern of marital fertility consistent with some family limitation.

For the country as a whole, the M index declined steadily during the decade under observation, with the exception of the most recent observation. This should not be taken as an indication that the underlying level of natural marital fertility was actually declining in Thailand. Although the M index is intended to "discount" changes in the extent of family size limitation, it is nevertheless sensitive to changes in the pattern of birth spacing, which, as indicated below, was apparently changing during the decade in question.

The fact that the m and M indexes need to be interpreted with caution for the case of Thailand is underscored by the relatively high values of the mean square error of the estimates. According to Coale and Trussell (1974), values of the mean square error above 0.01 indicate a rather poor fit between the observed marital fertility values and their model schedules; only values below 0.005 suggest a relatively good fit. The high value of the mean square error undoubtedly reflects, at least in part, sample fluctuations that result from basing age-specific marital fertility rates on relatively small numbers of cases. For example, the worst fits are indicated for the urban marital fertility rates from the particularly small urban samples of SOFT and NS. Although the Surveys of Population Change, which are based on far larger samples, do not directly yield age-specific marital fertility rates, they can be approximated by dividing the reported age-specific fertility rates by the proportions

married (which are provided directly for SPC2, but need to be estimated in the case of SPC1; see footnote 6). The resulting age-specific marital fertility rates from these two surveys fit reasonably well to the Coale-Trussell model, yielding the following values:

	m	M	MSE
SPC1	.12	.92	.001
SPC2	.40	.80	.005

Moreover, it also seems likely that rapid declines in marital fertility will result in dislocations of the age pattern such that they will not conform particularly well to the Coale-Trussell model.

PERCENT PREGNANT AND OPEN INTERVAL

Additional information on recent fertility trends is provided by data on the percent currently pregnant and the mean interval since last birth (see Table 10). In each case, the information on pregnancy status was derived from an independent question separate from the questions on birth histories that served as the basis for calculating the age-specific marital fertility rate. The reported percent pregnant is undoubtedly underestimated, since some women will not recognize an early pregnancy and there might be some hesitancy to admit pregnancy to an interviewer, especially if an abortion is contemplated. Since the extent to which pregnancy status reports are biased may vary from population to population, this measure is not suitable for comparing fertility among different populations (Goldman and Westoff, 1981). Nevertheless, if the bias is relatively constant within the same population, the percent pregnant can be used as an indication of trends in fertility, although it is more problematic as an indicator of fertility differentials. In the case of Thailand, the reported percent pregnant from the series of sample surveys for which this measure is available declines substantially in both rural and urban areas. These results are thus consistent with and help confirm the decline in marital fertility evident in the marital fertility rates calculated from these surveys. Moreover, the results for the CPS1, NS, and AFPH, all of which occurred within the span of a year's time, are quite consistent with each other with the exception of the

TABLE 10 Percent Pregnant at Time of Survey and Mean Number of Months Since Last Birth, Among Currently Married Women Aged 15-44, Standardized for Age, by Place of Residence: Thailand

	LS1 1969/70	LS2 1972/73	SOFT 1975	CPS1 1978/79	NS 1979	AFPH 1979	CPS2 1981
Rural							
Percent pregnant	16.2	14.9	12.2	10.0	10.3	9.9[a]	8.5
Open interval	28	34	41	49	51	--	52
Urban							
Percent pregnant	12.2	10.7	9.7	10.2[b]	11.9	8.8[a]	11.9
Open interval	49	50	53	51[b]	52	--	50
Total							
Percent pregnant	15.3	14.3	11.8	10.1[c]	10.4	9.8[a]	9.1
Open interval	31	36	43	49[c]	51	--	51

Note: The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis of the age standardization.

-- indicates information not available.

[a]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.
[b]Bangkok metropolitan area.
[c]Excluding provincial urban.

Sources: Knodel et al. (1980); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

urban values, which, as indicated above, are based on small numbers of women and refer to differently defined populations. Particularly noteworthy is the fact that the percent of respondents at the national level reporting themselves as pregnant in CPS2, the more recent survey, is lowest of all, suggesting a continuation of the fertility decline in contrast to the slight increase in marital fertility rates reported above.

This measure is less satisfactory for measuring rural-urban differences because urban women, who in general are better educated, may more readily recognize pregnancy at an early stage. The higher percent of urban as compared to rural women reporting themselves as pregnant in CPS2 may reflect such a difference rather than a genuine fertility differential. Nevertheless, it is noteworthy that if the CPS2 results are ignored, the pronounced urban-rural differential in percent pregnant

evident at the time of the earlier surveys contracts considerably over time, probably reflecting the more rapid fertility decline among rural women.

The mean interval since last birth among women aged 15-44 increased substantially in rural areas but changed little in urban areas. As a result, the urban-rural differential has disappeared. Since this measure is derived from the birth histories, it is not independent of the marital fertility rate measures. Nevertheless, these results together with those on the percent pregnant help support the finding that marital fertility has declined substantially in Thailand, and that this decline has been particularly pronounced among rural women.

COMPLETED AND EXPECTED FAMILY SIZE

The high fertility of Thailand's recent past is evident in the cumulative fertility of women currently at the end of their reproductive ages. According to CPS2, the most recent survey, ever-married rural women aged 45-49 reported an average of almost six and one-half children ever born, down only slightly from the seven births per woman reported in the earliest surveys (Kamnuansilpa and Chamratrithirong, 1982; Institute of Population Studies, 1981). Urban women experienced somewhat lower cumulative fertililty by the end of the reproductive span, amounting to about one child fewer than for rural women. Of course, mortality claims some of these births early in life. According to most surveys, the number of living children reported by women in their forties averaged about one less than the number of children ever born. We can expect this difference to decrease in the near future as a result of the recent declines in fertility and in infant and child mortality.

According to the 1960 and 1970 censuses, nearly 60 percent of every married woman aged 45-49 experienced six or more births (see Table 11). The increase in the mean and median children ever born between 1960 and 1970 may reflect in part a decrease in mortality rates, resulting in decreased widowhood among ever-married women. However, differences in the accuracy of the censuses cannot be ruled out as a reason for this increase. Preliminary data from the 1980 census, based on a 1-percent sample, show a considerable change in both the distribution and the mean and median number of children ever born compared to the 1960 and 1970 censuses for women at the end of the

TABLE 11 Percentage Distribution of Ever-Married Women Aged 45-49, by Children Ever Born and Living Children: Thailand

Number of Children	Children Ever Born			Living Children
	Census 1960	Census 1970	Census 1980[a]	Census 1980[a]
0	3.2	1.7	3.0	3.4
1	5.8	5.5	5.3	6.0
2	6.4	6.1	7.1	8.8
3	7.3	7.0	10.4	12.5
4	8.7	8.6	12.5	15.1
5	9.9	9.9	14.3	16.4
6	10.6	10.8	13.1	13.7
7	10.9	11.0	10.8	10.1
8	10.3	10.6	8.5	6.5
9	9.0	9.2	5.9	3.8
10+	17.8	19.7	9.1	3.7
Total Percent	100	100	100	100
Mean	6.29	6.55	5.61[b]	4.91[c]
Median	5.82	6.04	4.82	4.26

Note: Excludes women with unknown numbers of children ever born or living children.

[a]Based on a 1-percent sample tabulation.
[b]Based on assumption that the average number of children ever born to women with 10+ births was 12.0.
[c]Based on assumption that the average number of living children to women with 10+ living children was 11.

Sources: 1980 census from unpublished preliminary tabulations of the 1-percent sample; 1960 and 1970 censuses from official published reports.

reproductive ages. The proportion of women with large numbers of children ever born has decreased substantially while the proportion with three to six children ever born has increased noticeably. There has been little change in the proportion with fewer than three children ever born. This shift in the distribution results in a substantial decline in the mean number of children ever born--by about one birth, compared to the 1970 census results. According to the 1980 results, half of Thai women aged 45-49 had between three and six births over their reproductive life. This downward shift in the distribution of children ever born to women at the end of the reproductive age span indicated by the 1980 census compared to earlier censuses is consistent with the evidence of fertility decline in the intervening period.

We would expect that the impact of reduced fertility at the early stage of a fertility transition would be greatest at the higher parities. However, some caution is called for in interpreting the 1980 census data on the extent of reduced cumulative fertility among women at the end of the childbearing years, because results from several recent surveys (CPS1, NS, and CPS2) do not register the same sharp reduction.

The 1979 NS results (not shown) indicate that about 14 percent of ever-married women aged 45-49 reported ten or more children ever born. This helps confirm the finding that the proportion of women with particularly large numbers of children ever born is declining, although the extent of the decline indicated by the NS is not as dramatic as that suggested by the 1980 census. Part of the reason for this may stem from the more intensive interviewing involved in the NS as well as the fact that detailed pregnancy histories were collected for each respondent, thereby increasing the chance that past births would be reported fully. Likewise, this difference in technique affects all comparisons between census and survey reports on mean number of children ever born. Sampling fluctuations also play a part in such comparisons and, in the case of the NS, part of the contrast with the census may be a result of a biased sample (Institute of Population Studies, 1981).

The preliminary results from the 1980 census also provide information on the distribution of the number of living children among women at the end of their reproductive span. As is the case with results from the sample surveys, the mean number of living children is approximately one less than the mean number of children ever born. Thus, over half of Thai women aged 45-49 report having two to five living children and less than 40 percent report six or more.

During a period of fertility decline, the completed family size of women at the end of their reproductive ages can no longer serve as an approximation of the completed fertility that younger women will eventually achieve by the time they reach the end of their childbearing years. We have attempted to estimate the future completed family size of currently married women still in the midst of their childbearing span by adding the number of additional children each respondent indicated she wanted to the number of living children she already had as of the date of the survey. For convenience, we label this measure the "expected number of children," although

in a strict sense it is based on future fertility desires rather than expectations. Moreover, it is based on living children rather than all live births, since we assume this is a more meaningful measure of family size and that respondents are undoubtedly expressing their future fertility desires in terms of living children rather than simply live births.

In contrast to the minimal change from 1970 to 1980 in the completed family size of women reaching the end of their reproductive ages, the expected number of children shows a substantial decline (see Table 12). Among both the rural and urban sample, the expected number of children calculated for the first round of the Longitudinal Study in 1969/70 is considerably higher at every age than the number indicated by CPS2 in 1981. Generally a consistent trend toward lower expected family size is evident during the intervening period. For Thailand as a whole, the number of children expected by women aged 15-44, after standardization for age, declined by about one child during the period spanned by the surveys. Moreover, it is far below the 5 to 6 living children currrently reported by women who have already reached the end of their childbearing ages.

A clear positive relationship with age is evident for all surveys with respect to the expected number of children. From these figures alone, it is not possible to distinguish the role of differing family size preferences by age cohort from the role of increasing risk of exceeding preferred family size with age, as a result of longer exposure to childbearing; the measure as defined would be sensitive to both. The trend toward lower expected numbers of children among women in the younger age groups, who are less likely to have exceeded their desired fertility, suggests that family size preferences were declining during the period under observation. The decline in expected number of children among women in the older age groups undoubtedly reflects the ongoing decline in marital fertility. The reduction in expected number of children among younger women combined with the increased prevalence of contraception and abortion (see Chapter 5) reflects not only the continuing fertility decline during recent years but also implies a total fertility rate in the future well below current levels unless the expectations are grossly exceeded. Moreover, the rural-urban differences in the expected number of children are rather modest among younger women and are far below the approximately one child difference in the

TABLE 12 Expected Number of Children by Age and Residence for Currently Married Women Aged 15-44: Thailand

Residence and Age Group	LS1 1969/70	LS2 1972/73	SOFT 1975	CPS1 1978/79	NS 1979	AFPH 1979	CPS2 1981
Rural[a]							
15-19	3.27	3.15	2.71	2.34	2.69	2.50	2.39
20-24	3.17	3.16	2.96	2.55	2.90	2.55	2.50
25-29	3.88	3.79	3.34	3.03	3.22	3.08	2.76
30-34	4.34	4.15	4.20	3.70	3.84	3.79	3.40
35-39	5.57	5.58	4.88	4.55	4.59	4.85	4.22
40-44	5.95	4.61	5.46	5.26	5.33	5.27	4.93
15-44							
Unstandardized	4.61	4.06	4.02	3.72	3.96	3.64	3.43
Standardized for age	4.42	3.97	4.00	3.64	3.82	3.74	3.41
Urban[b,c]							
15-19	2.77	2.64	(2.59)	(2.21)	(2.38)	2.00	(1.75)
20-24	2.94	2.88	2.73	2.22	2.59	2.52	2.23
25-29	3.43	3.21	3.21	3.00	2.62	2.88	2.31
30-34	4.14	3.75	3.25	2.98	3.58	3.43	2.77
35-39	4.68	4.47	4.03	3.80	3.81	3.92	3.29
40-44	5.44	5.36	4.66	4.37	4.69	4.78	3.74
15-44							
Unstandardized	4.09	3.87	3.50	3.19	3.52	3.33	2.77
Standardized for age	3.97	3.77	3.45	3.15	3.32	3.34	2.74
Total[a,c]							
15-19	3.21	3.09	2.70	2.32	2.66	2.46	2.31
20-24	3.13	3.12	2.93	2.49	2.85	2.56	2.46
25-29	3.80	3.69	3.32	3.02	3.11	3.06	2.67
30-34	4.30	4.08	4.08	3.57	3.79	3.76	3.28
35-39	5.43	4.56	4.77	4.41	4.44	4.79	4.05
40-44	5.87	4.70	5.36	5.12	5.21	5.22	4.74
15-44							
Unstandardized	4.51	4.03	3.95	3.63	3.[illegible]	3.61	3.31
Standardized for age	4.35	3.94	3.93	3.56	3.73	3.71	3.29

Notes: Expected number of children equals the number of living children plus additional children desired. Results in parentheses are based on fewer than 50 cases. The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis of the age standardization.

[a]AFPH results refer to a universe of 20 provinces.
[b]Bangkok metropolis for CPS1 and provincial urban from a universe of 20 provinces for AFPH.
[c]Excluding provincial urban for CPS1.

Source: CPS2 from Kamnuansilpa and Chamratrithirong (1982).

TABLE 13 Number of Living Children at Time of Study, Additional Number of Children Desired, and Total Expected Number of Children by Age and Residence, for Currently Married Women Aged 15-49: Thailand

Residence and Age Group	LS1 1969/70			NS 1979			Difference (NS-LS1)		
	Living Children to Date	Additional Number Wanted	Total Number Expected[a]	Living Children to Date	Additional Number Wanted	Total Number Expected[a]	Living Children to Date	Additional Number Wanted	Total Number Expected[a]
Rural									
15-19	.61	2.65	3.27	.46	2.24	2.69	-.15	-.41	-.58
20-24	1.44	1.73	3.17	1.17	1.73	2.90	-.27	0	-.27
25-29	2.69	1.20	3.88	2.26	.96	3.22	-.43	-.24	-.66
30-34	3.66	.68	4.34	3.40	.44	3.84	-.26	-.24	-.50
35-39	5.24	.33	5.57	4.26	.33	4.59	-.98	0	-.98
40-44	5.69	.26	5.95	5.22	.12	5.33	-.47	-.14	-.62
45-49	[b]	[b]	[b]	6.05	.09	6.15	[b]	[b]	[b]
Urban									
15-19	.64	2.13	2.77	--	--	--	--	--	--
20-24	1.33	1.61	2.94	(1.27)	(1.32)	(2.59)	(-.06)	(-.29)	(-.35)
25-29	2.33	1.10	3.43	1.83	.78	2.62	-.50	-.32	-.81
30-34	3.47	.66	4.14	2.90	.68	3.58	-.57	+.02	-.56
35-39	4.28	.40	4.68	3.49	.32	3.81	-.79	-.08	-.87
40-44	5.24	.20	5.44	4.49	.20	4.69	-.75	0	-.75
45-49	4.96	.23	5.19	(4.89)	(.18)	(5.08)	-.07	-.05	-.11

Note: Results refer only to women for whom an expected number of children could be calculated. Results based on at least 10 but fewer than 50 cases are shown in parentheses; results based on 10 or fewer cases not shown.

[a]Expected number of children equals the number of living children plus additional children desired prior to rounding to two decimal points.

[b]In the rural round of LS1, women over 45 were not asked about the number of additional children desired.

average number of living children that currently characterizes rural and urban women in their late forties (Institute of Population Studies, 1981; Kamnuansilpa and Chamratrithirong, 1982).

An examination of the separate components of the total number of children expected (living children to date and additional number wanted) for LS1 and NS, two surveys taken a decade apart and based in part on the same respondents, provides some insight into the nature of the changes in expected family size and the validity of this measure as a predictor of future family building (see Table 13). For both rural and urban samples, the achieved number of living children at the time of interview declined for every age group between the two surveys. If measured by children ever born rather than living children, the decline in fertility would be even greater, since decreasing mortality rates in the interim increased the proportion of births that were still living at the time of the NS survey. For all ages except the youngest, most or all of the decline in the total expected number of children is attributable to the decline in achieved family size rather than in reduced numbers of additional children wanted. Nevertheless, it is noteworthy that despite the lower number of living children for women in each age group in 1979, the additional number of children wanted either remained about the same or declined compared to the situation a decade earlier. Thus the reductions in achieved fertility are clearly not the result of postponed births intended to be made up later but reflect instead a demand for fewer children.

Given the ten-year interval between the two surveys (nine years for the urban samples), some indication of how well responses concerning the additional number of children wanted predict subsequent fertility behavior can be found by comparing the total number of children expected for each age group of women in the first survey with the achieved number of living children reported by women ten years older a decade later. One problem in interpreting such a comparison is created by the fact that the information in Table 13 refers only to currently married women. Since the average age at first marriage in Thailand is in the early twenties, married women in the youngest age group, especially in the 15-19 age group who were interviewed for LS1, may not be typical of married women ten years older interviewed in the NS. The latter group would include cohort members who married

during the intervening ten years as well as those who were already married when the cohort was aged 15-19. This problem is less serious for cohorts that were somewhat older at the time of LS1, since most women marry prior to age 25. Despite this problem, a cohort-by-cohort comparison of achieved number of living children in 1979 with the expected number ten years earlier (at the time of LS1) clearly indicates that fertility desires as originally stated were exceeded. For the rural sample this is true for every cohort for which this comparison can be made, with the exception of the women who were 15-19 at the time of LS1. For the urban sample, the achieved number of living children in 1979 was lower than the total number expected in 1970, approximately the same for the cohort aged 20-24 in 1979, and larger for the cohorts that were in older age groups.

Except for the cohort aged 45-49 in 1979 (and thus aged 35-39 ten years earlier), the final family size will undoubtedly be larger than the number of living children reported at the time of the interview in 1979. Thus a closer estimation of the extent to which final family size will exceed the expected family size as indicated in LS1 can be obtained by comparing for each cohort the total number of children expected in 1979 with the expected number indicated a decade earlier. In this comparison, only women who were aged 15-19 at the time of LS1 in both rural and urban samples have lower expected numbers of children in 1979. This is probably a result of the selectivity problem referred to above. The subset of women who marry at particularly young ages among a given cohort are prone to higher completed fertility. Thus the expected number of children to the subset of women aged 25-29 in 1979 whose first marriage occurred at least ten years earlier is higher than both the expected number for all married women aged 25-29 in 1979 and the expected number as calculated for married women aged 15-19 from LS1.[10]

The extent to which the future fertility of any given cohort will exceed the additional number of children wanted is undoubtedly heavily dependent on the prevalence of fertility control practices. Thus we would expect that as contraceptive prevalence and abortion increase, final family size will be closer to the expected number as defined by the present measure. In this connection, it is worth noting that the correspondence on a cohort basis between the total number of children expected as of LS1 for the urban sample agrees more closely with both

the achieved number of living children in 1979 and the total number expected in 1979 than is true for the rural sample, where contraceptive prevalence during most of the period was substantially below that of the urban areas.

In sum, Thailand is currently in the midst of a major decline in fertility. Although it is difficult to date the onset of the fall in fertility with precision, most evidence indicates that the decline started to gain momentum during the 1960s and, for the rural population, probably dates largely from the latter part of the decade. A decomposition of changes in the crude birth rate between the mid-1960s and mid-1970s suggests that neither changes in the age structure nor in the proportion married among women in the reproductive ages contributed in a major way to the declining birth rates. Rather the reduction is largely a matter of a fall in marital fertility. Between the end of the 1960s and the early 1980s, survey evidence indicates that marital fertility fell by almost 40 percent, representing one of the most rapid fertility reductions in the developing world. This reduction in marital fertility is supported by data showing decreases in the percentage of women who are currently pregnant and increases in the average length of the open birth interval.

During the last decade, the decline in fertility appears to have been more pronounced in rural than in urban areas, thus narrowing the formerly substantial rural-urban differential in fertility levels. Regional differences in both the timing and extent of decline are also apparent, although by the early 1980s all areas of Thailand are apparently participating in the ongoing fertility transition. Reductions in the expected number of children during the last decade both reflect the continuing fertility decline and, especially among younger married women, imply a continuation of the recent fertility trends, at least for the near future.

NOTES

[1]The normal expectation would be for the estimates based on the dual-record system approach to be higher than those based on retrospectively reported births from single, cross-sectional surveys. The apparent agreement in the Thai case may be the fortuitous result of compensating errors in the estimates based on the single surveys. It is possible that births are incompletely

reported in the surveys, as would be expected, but that errors in dating the births, either by the respondent or in the process of coding, result in more births being reported as occurring during the year prior to the survey than would be the case if the dating of all reported births were correct. This could then inflate the fertility rates based on births retrospectively reported as occurring in the year prior to the survey so they would agree with levels implied by dual-record system estimates.

One hint that this may be the case is provided by the fact that estimates of fertility from most Thai surveys based on births reported as occurring during the second year prior to the survey are regularly lower than estimates based on births reported as occurring during the first prior 12 months (National Research Council, 1980). This finding is the opposite of what we would expect to be the true case under circumstances of declining fertility. An examination of the procedures used by coders and interviewers to convert reported animal-year dates into Buddhist Era calendar dates suggest that a shift of some births from the second year prior to the survey into the first prior year might have occurred in the process. However, this explanation is at present only an hypothesis and must be examined further before a sound judgment on its validity can be made. A variety of other potential explanations could also account for the agreement, including ones involving errors in the dual-record system estimates.

[2]The measure is similar to the index of marital fertility I_g', proposed by Coale (1969) except that it directly standardizes for age, in the present case using the age distribution of currently married women as reported for the whole country in the 1970 Thai census. For a detailed discussion of I_g', see Knodel (1979).

[3]These rates were calculated from Shevasunt and Hogan (1979:Table 3.1). In that table, rates are given only up through age 44 and thus the 45-49 group is ignored in the calculation of I_g'. The rates for Chiang Mai province and Chieng Rai province were combined using weights of 779 and 1,142, respectively, which refer to the total number of currently married women aged 15-44 that were interviewed. The number of women on which each five-year age group rate is based is not provided in the report.

[4]While age reporting is relatively good in Thailand and most people know their age and year or date of birth, there is substantial evidence of a tendency to state age at next birthday in preference to age at last birthday in response to a direct question about age. Although the precise extent to which this practice occurs has not yet been determined, it seems clear that at any given age, a substantial proportion of respondents state their age at next birthday as opposed to age at last birthday; there is some evidence that the tendency is to round age to that at the nearest birthday (Chamratrithirong et al., 1978). In the 1960 census, age was tabulated on the basis of a direct question on age, while in the 1970 census and other sources age was calculated from the reported date of birth. Thus, age as reported in 1960 tends to be half a year lower on average than would be the case if age at last birthday had actually been reported.

[5]Chamratrithirong (1980:12) has speculated that the SPC2 data underestimates the true proportions single and that the results from SOFT are more accurate because of the way temporarily absent members of the household and temporary visitors were treated.

[6]The necessary data on the age-sex distribution are provided in the reports of SPC1 and SPC2. Data on the proportion of women currently married by age group are also provided directly for SPC2. The proportions currently married at the time of SPC1, however, were not available directly and were estimated by linear interpolation between the 1960 census (after adjustment for a half-year age misstatement) and the 1970 census. Both SPC1 and SPC2 provide age-specific fertility but not age-specific marital fertility; the latter was estimated by dividing the age-specific fertility rates by the proportions married.

[7]Since we had access only to the proportions single by age for 1980, we calculated the proportions <u>currently</u> married by multiplying the proportions <u>ever</u> married in 1980 (the complement of proportions single) by the ratio of currently married to ever-married women as observed in the 1970 census.

[8]The crude birth rate, given the alternative proportions currently married, was calculated by multiplying

the observed age-specific birth rates by the ratio of the alternative proportions currently married to the proportions currently married recorded in SPC2 at each age and then multiplying through by the observed age structure.

[9]Only the date of the most recent birth was asked in CPS1 and CPS2, but this suffices for calculating marital fertility in the year prior to the survey provided we ignore the very small number of next-to-last births that occurred 10 to 12 months prior to interview.

[10]More precisely, the expected number of children born to women who were aged 25-29 at the time of the NS and who indicated their age at first marriage was ten or more years younger than their current age was 3.59 for the rural sample (N = 75) and 2.80 for the urban sample (N = 10).

CHAPTER 3

PROXIMATE DETERMINANTS 1: FAMILY FORMATION AND DISSOLUTION

A clear prerequisite of fertility is "exposure" to sexual intercourse. In most societies, including Thailand, most such exposure occurs within marital unions, although it may also occur to varying extents outside of marriage. In this chapter we focus on the category of proximate fertility determinants that Bongaarts refers to as exposure factors. We start with a discussion of sexual relations and fertility outside of marriage, a topic that has received little previous attention in the demographic literature at least, and then turn to the more familiar topics of marriage, marital dissolution, and remarriage. Finally, we examine evidence on temporary separation of spouses, another topic that has received limited attention but which also plays a part in determining the extent of exposure to sexual relations.

PREMARITAL SEX, PREMARITAL PREGNANCY, AND ILLEGITIMACY

There is relatively little solid data on the extent of premarital sex, premarital pregnancies, and illegitimacy in Thailand. Quite probably the extent and nature of premarital sexual relations and their outcomes differ regionally and between rural and urban areas. Moreover, there is little reason to expect that these matters have remained constant over time.

There are a variety of judgments offered in the anthropological literature with respect to the extent of premarital sexual activity. The conclusions are usually limited to the villages under study, ranging from very little to more common (Kaufman, 1976:149; Potter, 1977:ii; Yoddumnern, 1981; Mougne, 1974, Part III:1; Riley, 1972:115). These differing opinions may reflect

genuine regional and temporal differences or they may stem from different personal biases or abilities at inquiry among the observers. Judging the extent of premarital sexual activity is made more difficult by the lack of a sharp distinction in at least some areas of Thailand between de facto cohabitation and marriage. While some form of ceremony associated with the start of cohabitation is usual, it is not universal (Riley, 1972:117; Yoddumnern, 1981). Since the anthropologists do not provide us with quantitative estimates, perhaps the most that can be said is that there is some premarital sexual activity in rural Thailand but that it is uncertain to what extent it is simply a prelude to more permanent cohabitation by the same couple and thus in a sense part of what might be considered a courtship process leading to marriage.

Prostitution in a variety of forms is an additional source of premarital sexual activity in most urban areas and especially in Bangkok. Patronization of prostitutes is undoubtedly quite common among unmarried (and married) urban Thai males. For example, about one fourth of a sample of Bangkok schoolboys, mostly aged 15-17, and almost two thirds of a sample of unmarried Bangkok male factory workers, mostly aged 18-20, indicated in a survey that they had visited a brothel at least once (Muangnan, 1979:44). The number of unmarried (including separated and divorced) urban women involved in some form of prostitution is also not insignificant (Muangman and Nanta, 1980; Thitsa, 1980) with some unknown and possibly substantial number of illegitimate births resulting. Since the legitimacy status of a birth is not officially recorded at the time of registration, no statistics are available on the proportion of registered births that occur outside of marriage.

Attempts have been made to estimate the extent of premarital births and conceptions by comparing retrospectively reported dates of first marriage and first birth provided in several surveys. For example, according to such calculations based on SOFT, 5 percent of women whose marriage occurred at least five years before the survey were classified as having experienced a first birth prior to their first marriage, and an additional 7 percent were classified as having experienced their first birth within the first seven months of marriage (Institute of Population Studies and National Statistical Bureau, 1977:55). Based on a survey of two northern Thai provinces, Hirschman and Rindfuss (1981)

calculate that 17 percent of ever-married women in the reproductive ages experienced an illegitimate or premaritally conceived first birth. About half of these were born before marriage and the other half conceived before but born after marriage. Data from the Asian Marriage Survey (AMS) indicate that among post-marital first births, approximately 12 percent in the general Bangkok sample, 9 percent in the Bangkok slum sample, and 13 percent in the semi-rural area occurred within eight months of marriage.

Unfortunately, there are sufficiently serious problems with this method of estimating the extent of premaritally born or conceived births that little confidence can be placed in the results. The most serious problem stems from the fact that the validity of such calculations depends on the accuracy with which the dates of first marriage and first birth are reported. In a substantial proportion of cases, respondents cannot recall precisely the month and year of first marriage or, less frequently, of first birth. In such cases, dates are typically imputed prior to actual tabulation. For example, in over 40 percent of the first birth intervals that indicated either a birth prior to first marriage or a birth within the first eight months of marriage from SOFT, imputation of first marriage and/or first birth was required. Of course, some first births treated as post-maritally conceived also involved imputation of dates and might in fact have been premaritally born or conceived. The point, however, is that with such a high proportion of imputation among cases classified as premarital births or conceptions, the validity of the resulting figures is open to serious question.

There may also be deliberate misreporting of dates of first marriage and first birth. Some respondents may attempt to cover up an illegitimate or premaritally conceived birth by adjusting the reported dates accordingly. Others may fail to mention a previous marriage, a sensitive issue for some couples in Thailand, but correctly indicate the date of their first birth when reporting a full pregnancy history. We suspect that many of the negative intervals between marriage and first birth result from such a reporting pattern. Moreover, given the dependency of this approach on a high level of accuracy in dating the event of first marriage and first birth, it is particularly sensitive to errors associated with converting dates reported in terms of animal years and lunar months into more conventional dates, estimates

made by interviewers when the respondent is unable to give precise information, and coding errors. Finally, the fact that typically only married women are included in the surveys on which these calculations are based means that single women who have a birth but do not marry are systematically excluded. Given all these problems, we believe little weight can be placed on calculations of this sort.

Several behavioral and attitudinal indicators of premarital sexual activity in Thailand are available from information collected in the AMS (see Table 14). In response to a question as to how soon after marriage the union was consummated sexually, a small number of respondents explicitly mentioned that they had had sexual relations with their husband prior to marriage. This varied from 5 percent in the semi-rural sample to 15 percent among the Bangkok slum example. We suspect that these figures understate, possibly substantially, the true extent of premarital intercourse among couples who eventually marry, both because the wording of the question implicitly assumed consummation subsequent to marriage and because we expect some respondents would be hesitant to admit having started sexual relations prior to marriage. The significance of the results lies rather in showing that some respondents admit to premarital sexual relations with their husbands when not explicitly questioned about it, thus indicating at least some premarital sexual activity of this sort.

Information about opinions and attitudes concerning premarital sexual experience is also available from AMS. In all three subsamples, the vast majority of respondents believed that men have sexual experience prior to marriage. This is not surprising given the fact that respondents are probably including experience with prostitutes in their assessment. More surprising is the substantial proportion who think that women also have sexual experience prior to marriage, again suggesting the premarital sexual activity other than involvement with prostitution may be relatively common. Approval of sex before marriage, as expressed by female respondents, suggests that a very strong double standard is the norm in Thailand. In all three subsamples, respondents were much more likely to indicate approval of sex before marriage for men than for women. In both cases, the proportion approving is substantially lower than the proportion who think that premarital sexual activity actually occurs.

TABLE 14 Selected Behavioral and Attitudinal Indicators of Premarital Sex as Reported by Ever-Married Women Aged 15-44: Thailand

Indicator	Bangkok General	Bangkok Slum	Semi-Rural
Percent reporting consummation prior to marriage	6.0	14.7	5.1
Percent who think men have sexual experience prior to marriage	95.3	93.9	89.5
Percent who think women have sexual experience prior to marriage	43.1	52.2	47.5
Percent who approve sex before marriage for men	71.5	63.9	52.8
Percent who approve sex before marriage for women	10.1	17.8	10.7
N[a]	514-515	504-507	653-657

[a]Varies slightly from question to question depending on the number of nonrespondents.

Source: Chamratrithirong (1982).

Additional information on attitudes toward premarital intercourse is provided in a study by Muangman (1979) based on a nonrandom sample of adolescent school and factory workers in Bangkok and in a northeastern province. When asked if premarital intercourse was permissible among couples who had no plans for engagement, approval among female respondents was quite low, varying from 3 percent among northeastern factory workers to 14 percent among Bangkok schoolgirls. Approval among male respondents was higher, ranging from 23 percent among northeastern factory workers to 38 percent among Bangkok schoolboys. Approval of premarital intercourse, however, was considerably higher when the situation referred to in the question pertained to couples who planned to get engaged or married or were already engaged. Again, substantial male-female differences persisted. Approval by female respondents of premarital intercourse between engaged couples varied from 18 percent for northeastern factory workers to 37 percent among Bangkok factory workers; for male respondents approval varied from 43 percent of Bangkok factory workers to 63 percent of Bangkok schoolboys.

The results from the study of adolescents and the AMS as well as comments from various anthropologists strongly suggest that premarital sexual activity in Thailand is not unconditionally disapproved, at least by and for substantial proportions of the population. The extent to which this limited tolerance of premarital intercourse

reflects or leads to actual premarital activity is not possible to gauge from available data nor can we estimate the impact on fertility levels. It is a factor that clearly requires more careful and detailed research than currently exists before any final assessment can be reached.

NUPTIALITY

Although there is evidence of some premarital sexual activity and even illegitimacy in Thailand, fertility is predominantly confined to marital unions. Since the onset of marriage (defined as socially recognized cohabitation) marks either the onset of or an increase in exposure to the risk of pregnancy, the age at first marriage, the proportion who ever marry, and patterns of marital dissolution and remarriage all have an important influence on the overall level of fertility.

In Chapter 2, we examined the proportions single at different ages and the singulate mean age at marriage over the last two decades. While not completely consistent, the data appear to point to some increase in the age at marriage but still nearly universal marriage among both men and women. In Thailand the singulate mean age at marriage for women is between 22 and 23 and approximately 40 percent of women aged 20-24 are still single. On a worldwide basis, Thai age at marriage is intermediate between a much earlier pattern characterizing much of the Third World and a later age at marriage characteristic of much of Europe (Chamratrithirong, 1980), although it should be noted that marriage patterns are in a state of flux in many countries.

The relatively low proportion still single by ages 45-49 among women is more typical of less-developed countries than of many Western nations. This has led Chamratrithirong (1980) to speculate that Thailand may be in a state of transition in which not only is the age at marriage slowly rising but the eventual proportion who ever marry is decreasing. He argues that this latter phenomenon is not yet apparent in the statistics because the cohorts currently at the end of the reproductive years are characterized by the former pattern of earlier and more universal marriage. If his interpretation is correct, over the next several decades as the younger cohorts reach the end of the reproductive years, an increase in proportion never marrying should become

evident. In this connection, it is worth noting that in contrast to the 2 or 3 percent of women who were classified as still single at ages 45-49 in all other sources, the preliminary results of the 1-percent sample of the 1980 census show 4.4 percent of that age group as single, higher than any previous figures.

Given the lack of consistency in the evidence examined so far on changing patterns of nuptiality in Thailand, it is useful to examine direct reports on age at first marriage which have been collected in the various sample surveys. One way to do this is to compare the reported age at first marriage of different age groups and hence different cohorts included in each survey. The main problem with these data is that the nuptiality experience of only the oldest cohorts can be considered to be close to complete as not everyone at the younger ages who will eventually marry has done so by the time of the survey. Thus a direct comparison of the mean age at marriage for different cohorts would be biased, since ceteris paribus the mean would be higher the older the age of the cohort at the time of the survey. One way to avoid this bias is to compare the mean age of those who marry before a given age across cohorts who have already reached that age at the time of the survey.[1]

In order to examine whether there has been a trend toward later or earlier marriage, the age at marriage for women marrying before age 25 has been calculated for women aged 25 and above (see Table 15). Had the age at marriage been increasing, the results should show a rise with decreasing age. Several of the surveys point to an increase in the age at first marriage over the recent past among urban women. The results for most of the surveys do not show a clear-cut tendency in this direction for the rural or the total population for which the rural population carries a heavy weight. A similar analysis based on ever-married women in the rural northeast interviewed in NES also revealed little change, with age at marriage under 25 fluctuating only between 19.2 and 19.3 for different five-year age cohorts of women within the reproductive ages.

As Trussell (1980) has pointed out, one drawback of this approach is that the experience of the youngest cohorts, those under age 25, is omitted from the analysis and thus the most recent trends are not revealed. This may explain in part why the increase in age at marriage indicated between the 1970 and 1980 censuses is not confirmed. Of some interest in this connection are the

TABLE 15 Age at First Marriage Among Women Marrying Before Age 25, by Current Age and Residence: Thailand

Residence and Current Age Group	LS1 1969/70	LS2 1972/73	SOFT 1975	NS 1979	AFPH[a] 1979	CPS2 1981
Rural						
25-29	19.4	19.3	19.1	19.5	19.5	19.4
30-34	19.3	19.0	19.1	19.1	19.2	18.9
35-39	19.6	19.3	19.2	19.4	19.3	19.0
40-44	19.1	19.6	18.9	19.2	19.2	19.1
45-49	19.1	19.2	19.2	19.6	--	19.1
50+	19.3	19.2	--	19.1	--	--
Urban						
25-29	20.0	20.1	20.4	20.0	19.9	20.2
30-34	20.0	19.9	20.4	(20.5)	20.0	20.3
35-39	19.6	19.8	20.7	(20.5)	19.5	20.3
40-44	19.4	19.5	19.6	20.0	20.2	19.8
45-49	19.5	19.8	19.9	(19.2)	--	20.2
50+	19.2	19.3	--	19.7	--	--
Total						
25-29	19.5	19.4	19.3	19.6	19.5	19.5
30-34	19.4	19.2	19.2	19.3	19.3	19.1
35-39	19.6	19.4	19.3	19.6	19.3	19.2
40-44	19.1	19.6	19.0	19.4	19.3	19.1
45-49	19.1	19.3	19.3	19.5	--	19.2
50+	19.3	19.2	--	19.2	--	--

Note: Results in parentheses are based on fewer than 50 cases.

-- indicates age groups not included in surveys.

results of the three most recent surveys (NS, AFPH, and CPS2) since they would provide the most recent indication of a trend. In each of these surveys, the age at marriage for the 25-29 age group is older than the age at marriage for the 30-34 age group, perhaps reflecting the shift toward later marriage revealed by the comparison of the 1970 and 1980 censuses. Given the apparent fluctuation in the series for each of these surveys, this evidence can only be considered suggestive.[2] It is also posible for the age at marriage to increase without the change being already reflected in the average age at marriage of persons marrying under 25. For example, if the distribution of ages at marriage under 25 for those who marry under 25 remained unchanged while larger proportions of a

cohort married over 25, the average age at marriage of the entire cohort would increase but the age at marriage under 25 would remain the same. Thus for a variety of reasons, the lack of a clear trend in the age at marriage under 25 cannot be taken as conclusive proof of little change in age at marriage in Thailand.

A somewhat different approach to estimating trends in age at marriage has been taken by Trussell (1980), based on the results of SOFT. By applying the model nuptiality schedules developed by Coale to the reported ages at first marriage of successive age groups of ever-married women as well as to the same data in combination with information on the proportions ever married (tabulated from the household record collected in the survey), he is able to estimate the mean age at first marriage and the proportion who will eventually marry for each cohort. His results are reproduced in Table 16. By applying a model schedule, he is able to extrapolate the full nuptiality experience of each cohort based on their experience up to the date of the survey and thus avoid the downward bias on the mean age at marriage that would result from direct calculations based only on experience to date.

Two slightly different series of mean ages at first marriage were calculated depending on whether the model was applied only to the reported ages at first marriage or to the combination of these data with the proportions

TABLE 16 Estimates of the Mean Age at Marriage and Proportions Eventually Marrying for Women, Based on Fitting the Coale Model Marriage Schedule to Individual Data on Age at Marriage Alone, and Combined with Data on Proportions Ever Married from the Household Schedule of SOFT: Thailand

Cohort	Estimated Mean Age at First Marriage		Estimated Proportions Eventually Marrying (from combined data)
	Individual Data	Combined Data	
20-24	21.2	21.4	.900
25-29	21.1	21.2	.921
30-34	20.8	20.8	.929
35-39	20.7	20.7	.945
40-44	20.2	20.2	.963
45-49	20.3	20.3	.967

Source: Adapted from Trussell (1980).

ever married derived from the household schedule. Both series suggest that a modest increase in the age at first marriage has been underway over recent decades. In addition, Trussell's estimates of the proportion that will eventually marry suggest that a movement away from virtually universal marriage is also taking place. These results, of course, are only estimates and depend both on how well the model nuptiality schedule fits actual Thai experience and on the accuracy of the data used in the calculations. A decrease in the proportion eventually marrying to only 90 percent, as indicated by Trussell's estimates, implies a rather radical change in this aspect of the Thai nuptiality pattern and probably should be taken only as suggestive of the direction in which the change is occurring rather than an indication of the actual magnitude to be expected.

It is worth noting that Trussell's estimates of the mean age at first marriage even for the more recent cohorts are lower than any of the singulate mean ages at first marriage calculated from the proportions single as reported in the various censuses and surveys included in Table 8. Part of the reason for this discrepancy derives from the fact that when calculations of the singulate mean age at first marriage are based on a single cross-section from a census or survey, they incorporate an assumption of unchanging marriage patterns over the recent past. Since the evidence seems to point to increases in the age at marriage and in proportions single, particularly at younger ages, over the last two decades, this assumption is not met. As a result, estimates of the singulate mean age at marriage that are based on single cross-sections tend to be biased upward. Agarwala (1962) has proposed a method of calculating the singulate mean age at marriage that avoids the assumption of unchanging nuptiality, provided data are available for two points in time.[3] The resulting calculations reflects the age at marriage implied by the nuptiality experience during the period intervening between the two sets of observations and is no longer biased by changes that may have occurred prior to the first observation. Calculations based on the proportions single in the last three censuses (using a half-year adjustment for the 1960 census) yield a singulate mean age at marriage of 21.60 for the 1960-70 intercensal period and 21.99 for the 1970-80 intercensal period. As expected, these estimates of the singulate mean age at marriage are lower than would be obtained if we simply averaged the estimates derived from each census

separately. Nevertheless, the estimates are still somewhat higher than those provided by Trussell even for the most recent cohort, suggesting some deviation between the marital experience as recorded in the actual data and that reflected in the model nuptiality schedules.

Substantial differences in nuptiality patterns exist between rural and urban residents in Thailand. As indicated in Table 17, the percentage single as recorded in the 1970 census is higher at every age among urban residents than among their rural counterparts. This holds equally for men and women. The singulate mean age at marriage is approximately three years higher for both men and women living in urban areas than for rural residents of the same sex. The largest absolute rural-urban differences are in the age group in the twenties and thus for the ages at which fertility is potentially highest. Some difference still persists even at the end of the reproductive ages, although the percentage remaining single is low enough to suggest nearly universal marriage even in urban areas. Analysis based on the first round of the Longitudinal Study as well as the 1970

TABLE 17 Percentage Single by Age, Sex, and Residence, and Singulate Mean Age at Marriage (SMAM) by Sex and Residence, 1970: Thailand

	Percentage Single			
	Urban Areas		Rural Areas	
Age Group	Male	Female	Male	Female
10-14	100.0	99.7	100.0	99.5
15-19	98.1	89.2	95.8	79.5
20-24	80.8	59.2	60.4	33.7
25-29	43.8	30.8	20.4	12.8
30-34	20.2	16.3	8.1	6.7
35-39	10.3	10.1	4.4	4.5
40-44	6.1	7.1	2.7	3.4
45-49	4.8	5.5	2.0	2.7
50-54	3.9	4.2	1.6	2.3
Total standardized by age	58.0	51.9	50.2	42.8
SMAM	27.2	24.7	24.2	21.4

Source: Adapted from Chamratrithirong (1980).

census suggests that among urban residents differences exist between those living in Bangkok and those living in provincial urban areas, with the proportion single at any given age and the age at marriage being higher among Bangkok residents (Prachuabmoh et al., 1972; Chamratrithirong, 1980). Similar differences in the marriage patterns of the rural, provincial urban, and Bangkok populations are also evident from the special 1-percent tabulations of the 1960 census (Goldstein et al. 1973).

Regardless of which set of estimates are accepted as the most representative for Thailand, the age at marriage, especially for women is somewhat older than in many other less-developed countries. The probable recent rise in the age at marriage most likely reflects the same modernizing forces that apparently are changing nuptiality in other Asian countries (Smith, 1980). A cross-sectional analysis of 1970 census data by Chamratrithirong (1980) supports the sugggestion that socioeconomic change affected nuptiality in Thailand during the previous decade. In a cross-provincial analysis, both age at marriage and percentage single were positively related to socioeconomic characteristics, especially for men.

Even before the recent changes in nuptiality patterns, female age at marriage in Thailand appeared traditionally to have been moderately late by Third World standards. Lauro (1979) suggests that the prevalence of bride-price payments and the custom of male entrance into monkhood prior to marriage have acted as important factors contributing to delayed marriage. These factors would appear to be more relevant for explaining the male rather than the female age at marriage. If there is also a norm in favor of a narrow age gap between spouses, however, women's age at marriage would also be affected. Lauro also notes that residents of the village he studied frequently expressed a feeling that couples should not marry until they were old enough to shoulder the responsibilities of raising a family. Although temporary residence with the bride's parents is fairly common following marriage and may ease the financial burden faced by a newly married couple (Yoddumnern, 1981), this typically lasts only for a short period after which neo-local residence is established (Henderson, 1971; Limanonda, 1979). Support of the newlywed couple's children generally falls on the couple themselves rather than being absorbed by a composite household economy, as may be common in countries where age at marriage is quite

early (Davis, 1955). This relative economic and even social independence of newly formed families may well be a crucial factor in accounting for the relatively later age at marriage, as it is hypothesized to have been historically in Western Europe, although to an even more extreme extent.

The strong association between age at first marriage and completed fertility is evident in Table 18, which compares the mean number of children ever born by age at first marriage for ever-married women close to or past the end of the reproductive span as recorded by LS1 and NS, the two surveys spanning the decade of the 1970s. Almost without exception, the mean number of children ever born declined with increased age at first marriage. A useful summary measure of the bivariate association between age at first marriage and children ever born is provided by the slope of the least squares regression line.

Under conditions of natural fertility, the influence of age at first marriage on completed fertility presumably operates primarily through increasing the amount of time during the reproductive span that a woman is exposed to the risk of pregnancy. Under conditions of widespread fertility control within marriage, this link might be expected to be weakened as increased exposure time could be counteracted by earlier practice of contraception. However, as others have pointed out, even under conditions of widspread fertility control, there are a variety of mechanisms that can link these two variables (van de Walle, 1973; Bumpass and Mburugu, 1977). For example, as long as there is some contraceptive failure, the link between longer exposure and higher cumulative fertility should persist even if to a lesser extent. Younger marriages may also be associated with high fecundity, higher fertility desires, or socioeconomic characteristics associated with less efficient contraceptive practice. Thus while increased birth control within marriage could potentially lead to a weakening of the inverse association between age at marriage and completed family size, other outcomes are possible.

The results in Table 18 are mixed in this respect. At the time of LS1, only a small proportion of ever-married women aged 40-49 and almost none of those 50 and over indicated they had ever practiced contraception. During the decade of the 1970s, as documented in Chapter 5, contraceptive prevalence increased dramatically, and by 1979, the year NS was fielded, a substantial proportion

TABLE 18 Mean Number of Children Ever Born to Ever-Married Women Aged 40 and Over by Current Age and Age at First Marriage: Thailand

	Rural Women				Urban Women			
	40-49		50 and Over		40-49		50 and Over	
Age at First Marriage	LS1 1969	NS 1979	LS1 1969	NS 1979	LS1 1970	NS 1979	LS1 1970	NS 1979
Under 19	7.50	7.42	7.37	7.16	6.53	(5.96)	5.86	(6.73)
19-21	6.87	6.60	6.95	6.53	6.16	(4.77)	6.20	(6.00)
22-24	6.26	5.83	(6.91)	6.51	5.09	(4.85)	(4.61)	(5.46)
25-29	(4.97)	4.05	(5.04)	(6.11)	3.89	(4.20)	(4.02)	(5.08)
30-39	(3.50)	(2.14)	(3.92)	--	(2.74)	--	(2.17)	--
Regression Slope (b)[a]	-.24	-.35	-.21	-.14	-.27	-.17	-.23	-.24

Notes: A small number of women reporting an age at first marriage of 40 or over are excluded. Results based on 10 or more cases but fewer than 50 are shown in parentheses; results based on fewer than 10 cases not shown.

[a]Based on data for age at first marriage expressed in single years of age. All slopes are statistically significant at the .001 level.

of women at the end of their reproductive span, especially those aged 40-49, had practiced contraception at some time. Nevertheless, the relationship between age at first marriage and children ever born actually strengthened among rural women 40-49, according to a comparison of the regression slopes indicated for these women in LS1 and NS. Although the regression slope decreased for women aged 50 and above, for these women the change in contraceptive practice was probably less dramatic than for their younger counterparts. It is also interesting to note that for both LS1 and NS, the regression slopes indicate a stronger correlation for women aged 40-49 than for women 50 and over, despite the fact that undoubtedly higher proportions of women 40-49 practiced contraception than the older women at the time of each of the surveys. Results for the urban women are also mixed in this regard. Among women 40-49, the correlation indicated by the regression slope is weaker in 1979 than in 1970 and is virtually unchanged for women 50 and over. Since Thailand is still in a state of transition with regard to the spread of birth control, the relationship between age at first marriage and cumulative fertility may indeed weaken in the future, but so far the evidence does not point clearly in this direction.

MARITAL DISSOLUTION AND REMARRIAGE

Anthropologists typically have noted that divorce and remarriage are common in Thailand (Henderson, 1971:70). Divorces are even less frequently officially registered than are marriages. Instead, marital dissolution is typically the product of an informal process whereby one of the partners simply moves out. Information on marital histories has been collected in a number of demographic sample surveys. Apparently, this is a sensitive area of inquiry for at least some respondents, and interviewers have often reported that they have encountered respondents who seem reluctant to discuss their marital histories in detail. Thus there is probably a tendency to underestimate the extent of marital dissolution and remarriage based on such information. Nevertheless, as shown in Table 19, a substantial proportion of ever-married women report being married more than once when questioned about their marital histories. In each of the four surveys for which such data are available, the percentage married more than once is higher among rural women than among

TABLE 19 Percent Married More than Once by Age and Residence, Ever-Married Women: Thailand

Current Age	Rural				Urban				Total			
	LS1 1969	LS2 1972	SOFT 1975	NS 1979	LS1 1970	LS2 1973	SOFT 1975	NS 1979	LS1 1969/70	LS2 1972/73	SOFT 1975	NS 1979
15-24	4.8	3.1	5.4	2.9	2.1	1.7	5.6	0	4.4	2.9	5.5	3.2
25-34	10.1	9.0	10.2	5.1	4.8	4.3	4.6	2.4	7.6	8.2	9.4	4.6
35-44	12.3	11.8	19.2	10.9	7.6	5.6	5.5	3.6	11.5	10.8	17.3	9.5
45+[a]	20.0	22.3	17.4	13.4	9.2	6.8	8.2	6.8	18.2	20.2	16.0	12.3

[a]Limited almost entirely to women aged 45-49 for SOFT.

urban women. Indeed, perhaps as many as one in five among rural women remarry at least once by the end of the reproductive age span. Data from the first round of the Longitudinal Study indicate that among urban women, remarriage is indicated more commonly by those living in provincial urban centers than by those in the capital, although the extent of the difference is less marked than between rural and urban categories overall (Prachuabmoh et al., 1972).

David Smith (1981) applied life table techniques to data from SOFT in order to estimate probabilities of marriage dissolution and remarriage. Because he found a much higher probability of divorce and separation among women who marry at particularly young ages and because such a high proportion of married women under age 25 at the time of interview were concentrated among women who marry at early ages, much of his analysis is limited to women aged 25-49. Table 20, which summarizes his results on marriage dissolutions, indicates that almost one out of five Thai women can expect dissolution within the first 15 years of marriage and close to one out of four within the first 20 years. During the early years of marriage, divorce and separation are far more important sources of marital disruption than widowhood, and even by the end of 20 years they together account for over 60 percent of total dissolution.

While marital disruption is frequent in Thailand, so is remarriage, particularly for women who are at the younger reproductive ages at the time of dissolution. As

TABLE 20 Cumulative Proportions of First Marriages Dissolved as Estimated by Life Table Analysis, by Source of Dissolution and Duration of Union, Ever-Married Women Aged 25-49, 1975: Thailand

Duration of Union	Total Proportion Dissolved	Source of Dissolution	
		Widowhood	Separation or Divorce
2.5 years	.035	.002	.033
5 years	.094	.014	.081
10 years	.145	.037	.113
15 years	.190	.064	.135
20 years	.233	.090	.143

Source: Adapted from Smith (1981:Tables 3 and 4 [based on SOFT]).

is evident in Table 21, which summarizes Smith's life table analysis of the probability of remarriage, almost two thirds of women in the reproductive ages remarry within five years of marital disruption. Among women under age 25 at the time their first marriage ends, almost one third remarry within a year, well over half have remarried by two and one-half years, and almost four fifths by five years. Even among women aged 25-34 at the time of dissolution, half have remarried within five years. Only older women are likely to remain unmarried in large proportions. Hence high remarriage rates appear to counteract much of the potential loss of exposure to pregnancy risk that could result from the substantial rates of marital dissolution.

When a marriage is dissolved prior to the end of a woman's childbearing age span, it reduces exposure to childbearing to the extent a woman remains celibate during the period she is unmarried. In cases where the woman remarries, this reduced exposure is a result of the time spent between unions, while for women who do not remarry reduced exposure will extend from the time of the marital dissolution to the end of her reproductive span. Thus while age at first marriage affects the extent of reduced exposure to childbearing at the beginning of the reproductive span, marital dissolution influences exposure during the middle and later segments of this

TABLE 21 Cumulative Proportions of Women Remarrying Following Dissolution of First Marriage as Estimated by Life Table Analysis, by Age at Dissolution and Duration Since Dissolution, Ever-Married Women Aged 25-49, 1975: Thailand

Years Since Dissolution	Total	Age at Dissolution		
		Under 25	25-34	35+
1 year	.247	.327	.191	.085
2.5 years	.453	.587	.344	.186
5 years	.647	.796	.511	a

[a]Not given in source because sample size was under 50 cases.

Source: Adapted from Smith (1981:Table 8 [based on SOFT]).

span. Davis and Blake (1956) specified "the amount of reproductive period spent after or between unions" as one of their intermediate variables. The relationship of marital stability to fertility is complex, especially under conditions where deliberate fertility control is widespread (Thornton, 1978). For example, in cases where marital dissolution occurs due to marital discord, exposure may also be influenced by reduced coital frequency or abstinence during some period prior to the marriage break-up. Likewise, selection processes may complicate the observed relationship. For example, subfecundity or childlessness may encourage divorce or inhibit remarriage. Following marital disruption or remarriage, a woman's family size preferences may change. Thus the impact on exposure to pregnancy risks is but one of the several mechanisms that can potentially link marital disruption and fertility.

Based on the data coded from the marriage histories in LS2 and SOFT, it is possible to estimate the time spent between or following unions among ever-married women in the reproductive ages (see Table 22). As would be expected, the older the age group of women, the longer the average amount of time spent between or following unions. Although there is some disagreement in the results between the two surveys, especially for women toward the end of the reproductive span, both sets of

TABLE 22 Estimated Time in Years Spent Between or Following Unions Among Ever-Married Women Aged 15-49, by Age and Residence: Thailand

	Rural		Urban		Total	
Age Group	LS2 1972	SOFT 1975	LS2 1973	SOFT 1975	LS2 1972/73	SOFT 1975
15-19	.06	.10	.00	(.07)	.06	.10
20-24	.22	.18	.07	.16	.17	.18
25-29	.39	.31	.13	.15	.34	.28
30-34	.51	.55	.24	.26	.46	.51
35-39	.56	1.07	.51	.40	.55	.98
40-44	.60	1.10	1.14	1.43	.67	1.15
45-49	1.39	1.99	1.30	2.34	1.37	2.05

Notes: Results for LS2 exclude women with incomplete information in their marital histories; results from SOFT are based on the World Fertility Survey standard recode tape and thus include imputed information for women with incomplete marriage histories. Results in parentheses are based on fewer than 50 cases.

estimates suggest that the amount of exposure time to childbearing lost as a result of marital dissolution is not very large during the prime reproductive years and hence is unlikely to have a significant impact on fertility. It is only by the end of the reproductive span that the average amount of exposure time lost exceeds a year. The largest increments are generally evident between the last two age groups, suggesting that much of the exposure time lost for the 45 to 49-year-old women probably occurred toward the end of the childbearing years when their fertility rates would be low in any event.

The results indicate that the amount of time spent between or following unions is higher for rural women than for urban women at ages below 40. The reversal in this differential for women in their forties (except for women 45-49 in LS2) does not necessarily contradict the findings in Table 19, which consistently showed higher proportions married more than once among rural than urban women at all ages, since the time spent between or following unions depends on the particular combination of the extent of marital dissolution, the extent of remarriage, and the interval between dissolution and remarriage. Thus it is possible that marital dissolution is lower in urban areas but if remarriage is also lower or delayed longer, reduced exposure time could be higher. A more detailed analysis would be required before conclusions could be reached about the source of rural-urban differences in marital dissolution and the resulting reduced exposure time.

Based on his analysis of data from SOFT, Smith (1981:25) estimates that separation and divorce (holding widowhood constant) are responsible for a loss of only four and one-half months of marriage per capita during the 15 years between the prime fertility ages of 20 and 35. This amounts to only 3 percent of the time currently spent in marriage and thus is unlikely to have more than a marginal influence on fertility. Such an estimate, based only on loss of presumed exposure time, ignores possible complexities as referred to above in the relationship of marital stability to fertility, but is a useful starting point for assessing the extent of relationship.

The marital status structure of women in the reproductive years at any given point in time reflects the net impact of entry into marital unions, marital dissolution, and remarriage on the amount of time spent within marital

unions. Given the strong association between age and fecundity within the childbearing span, the implications of different marital structure distributions for fertility depend not only on the overall proportion in a given marital status, but also the age profile of women in different marital status categories. Coale (1969) has proposed an index of the proportion currently married among the reproductive ages that is weighted according to the age profile of natural fertility as represented by the age-specific marital fertility of the Hutterites. This idea has been extended to indexes of other marital statuses (Smith, 1978). The main advantages of these indexes are that they reflect not only the marriage pattern of women, but also the potential effect of their marital status on fertility. Thus, for example, the same proportion of women divorced toward the end of the reproductive span carries less weight than at earlier ages, when fecundity is presumed to be higher.

Table 23 shows a complete set of these marital status indexes for Thai women based on the 1970 census. Since the sum of the indexes is one, it is possible to determine the extent of reproductive potential (i.e., under conditions of natural fertility as embodied in the Hutterite marital fertility schedule) that is realized through marriage or lost through women being in various unmarried states (under the assumption that illegitimacy is negligible). Thus the results suggest that approximately 6 percent ($I_m = 0.646$) of the reproductive potential of Thai women in 1970 was realized through the existing marriage pattern. Of the 35 percent of potential unrealized, fully 30 percent ($I_s = 0.302$) was unrealized because of delayed or foregone entry into first marriage

TABLE 23 Marital Status Indexes for Women, by Residence, 1970: Thailand

Region and Area	Proportion Married I_m	Proportion Single I_s	Proportion Divorced I_d	Proportion Separated I_p	Proportion Widowed I_w
Whole Kingdom	.646	.302	.011	.020	.021
Urban	.523	.452	.009	.021	.015
Rural	.669	.278	.011	.019	.022

Source: Adapted from Chamratrithirong (1980).

and only 5 percent of potential fertility (the sum of $I_d + I_p + I_w$) was unrealized because of marital dissolution.

Thus, although marital dissolution is relatively common in Thailand, its impact on potential reproduction is not very large because much marital dissolution occurs at ages where fecundity is considerably past its peak. Among the three forms of marital dissolution, divorce and separation together have greater effect on fertility than widowhood. The impact of all three forms of marital dissolution on potential reproduction is greater in rural areas than in urban areas. Nevertheless, a substantially higher proportion of reproductive potential is realized through marriage among rural women than among urban women, as indicated by the substantially higher rural values on the I_m index. Thus the greater marital dissolution in rural areas is far more than compensated for by their earlier and somewhat more universal marriage pattern.

Several studies have examined the influence of marital dissolution on actual fertility in Thailand by determining differences in cumulative fertility by marital status. Goldstein et al. (1973) based their study on a special 1-percent sample of the 1960 census; Knodel and Prachuabmoh (1974) utilized data from the first round of the Longitudinal Study; Chamratrithirong (1980) analyzed the 2-percent sample of the 1970 census; and Smith (1981) examined data from SOFT. All studies show that at virtually all ages currently married women report higher mean numbers of children ever born than women previously but not currently married. Each study (except Smith's, which does not examine the issue) also finds that the cumulative fertility of widows exceeds that of divorced and separated women. For example, the 1960 census results indicate that at the national level, the age-standardized mean number of children ever born to widows is 78 percent as high as for currently married women, while for divorced and separated women combined it is only 57 percent as high.[4] Similarly, the 1970 census results indicate that nationally the age-standardized mean number of children ever born to widows is 80 percent as high as for currently married women; for separated women it is 67 percent as high; and for divorced women, 53 percent as high. Moreover, Knodel and Prachuabmoh, based on LS1, and Smith, based on SOFT, find that after controlling for age at first marriage, currently married women in their first marriage experienced higher cumulative fertility than remarried women.

As Smith (1981:27) points out, the difference in mean number of children ever born to ever-married women versus women in first marriages at the end of the reproductive ages can be taken as a crude estimate of the overall fertility cost of marital dissolutions. In his study, this difference amounts to 0.3 children for women aged 40-49. However, this may underestimate the impact, as it does not allow for the older age at first marriage of those still in their first marriage by the end of the childbearing ages. Based on data from LS1 and presented by Knodel and Prachuabmoh (1974:Table 7), we compared the mean number of children ever born to all ever-married women aged 45 and older with the mean for currently married women still in their first marriage, standardizing for age at first marriage for all ever-married women. The result was a difference of about half a birth. About 40 percent of ever-married women 45 and above in the LS1 sample were not currently in their first marriage. Thus if all ever-married women 45 and over experienced the same completed fertility as those still in their first marriage, completed family size would have been about 0.2 children higher (0.4 x 0.5 = 0.2) or about 3 percent more than observed. Hence on the micro-level, marital dissolution and disruption do influence cumulative fertility, but the overall impact on marital fertility levels is not great.

TEMPORARY SEPARATION OF SPOUSES

In addition to the permanent dissolution of a marriage, temporary separation of spouses acts as a source of involuntary abstinence, thus reducing exposure to intercourse and thereby influencing fertility levels. In particular, Davis and Blake (1956) cite the separation of couples due to migration as examples of such a situation. While available evidence for Thailand does not permit a definitive judgment on the extent to which temporary separation of spouses exists, there are several indications that temporary separations are not infrequent. In the officially published census reports, currently married persons with spouses present are not distinguished from those with spouses absent, although persons who are separated (presumably on a permanent basis) are distinguished from currently married persons.

However, special tabulations based on the 1-percent sample of the 1960 census and analyzed by Goldstein et

al. (1973) do subdivide the currently married population into those with spouse present and those with spouse absent. As Goldstein et al. point out, the category "married with spouse absent" undoubtedly includes a variety of situations. In some cases, permanent separation may have occurred but appropriate legal recognition is lacking or one of the spouses is reluctant to admit to the actual situation. Most of this category, however, may be attributable to more genuine situations of temporary separation created by the movement of one partner while the other has remained behind, either waiting for the absent spouse to return or to join the absent spouse at a later date. In addition, there may be other situations in which the spouses are living apart because their employment demands it, particularly in Bangkok, where the wife may be employed as a domestic servant. Finally, some women in this category may be minor wives who share their husband with other wives at different residences. Although not legally sanctioned, polygyny is known to exist in Thailand and is more or less socially acceptable (Riley, 1972:116; Henderson, 1971:70). In general, observers note that polygyny is rare in rural villages but may be more common in urban areas (Blanchard, 1958:435). Frequently, polygyny involves separate residences for the multiple wives. The fact that approximately 50 percent more women reported themselves as married with spouse absent compared to men might be attributable to the institution of minor wives, since otherwise these numbers should be equal (Goldstein et al., 1973).

Based on tabulations of the special 1-percent sample of the 1960 census, it is possible to calculate the percent of currently married women who report their husbands absent (see Table 24, Panel A). For the total sample, approximately 3 percent of currently married women under age 50 indicated their husband was absent, but this figure masks substantial rural-urban differences. As many as one in five women in Bangkok (after age-standardization) reported an absent husband, reflecting perhaps a greater prevalence of minor wives and higher urban rates of employment of married women as domestics, as suggested above.

To assess the extent to which reproductive potential is reduced through temporary separation of spouses, the same approach used to calculate the marital status indexes presented in Table 23 can be applied to the data on currently married women with absent husbands. The results

TABLE 24 Indicators of Temporary Separation of Spouses: Thailand

Part A. Percent of currently married women, aged 13-49, reporting husband absent, by age and residence, 1960

Age Group	Bangkok	Other Urban	Rural	Total
13-19	50.0	24.5	8.6	10.4
20-24	33.6	13.0	3.6	5.2
25-29	21.7	7.4	2.1	3.4
30-34	17.1	6.0	1.3	2.2
34-39	11.0	3.6	1.4	1.9
40-44	10.1	4.2	1.4	2.0
45-49	15.3	7.7	1.4	2.5
Age standardized total[a]	20.4	7.9	2.2	3.3

Part B. Percent of currently married usual residents of households listed as temporarily absent, by age, sex, and residence, April-May 1979

	Rural		Urban	
Age Group	Husbands	Wives	Husbands	Wives
Under 30	8.3	3.5	4.3	3.4
30-49	2.5	0.9	3.2	1.2
50+	1.4	1.2	0.7	1.0
Total[b]	3.3	1.7	2.6	1.7

Part C. Percent of married residents who were absent at least once during 1976-79, by age and sex, six villages in northeast Thailand

	Husbands		Wives	
Age Group	Percent Absent	N	Percent Absent	N
Under 30	44.1	102	21.4	140
30-49	27.7	213	2.9	208
50+	4.5	112	1.2	84
Total	25.5	427	8.6	432

Note: Results in Part A based on a 1-percent sample of the 1960 census but exclude the province of Thonburi.

[a]The age distribution of currently married women in the total sample was used as the basis for age standarization.
[b]Includes a small number coded as age unknown.

Sources: Part A: Calculated from Goldstein et al. (1973:Table 2).
Part B: NS.
Part C: Calculated from Lightfoot and Fuller (1981:Table 5).

indicate that for the total sample from the 1960 census, the reproductive potential of all Thai women was reduced by only 0.2 percent, although for the Bangkok sample this figure rises to 2.7 percent, reflecting the much higher prevalence of absent husbands in the capital. Goldstein et al. (1973) have shown that cumulative fertility at virtually all ages is substantially lower for women whose husbands were absent than for those with husbands present. For example, the age-standardized number of children ever born in 1960 was about one fourth lower if the husband was absent.

Another source of information about the extent of temporary separation between spouses is the data collected on individual members of households as part of sample surveys. In the NS, information was recorded on the household schedule for all usual residents of each sample household with an indication of whether they were present or temporarily absent, with definitions of "usual resident" and "temporarily absent" apparently left up to the respondent. One possible problem with this type of information is that absent spouses may not be reported as usual members of the household, especially if they have been gone for a relatively long time.

The percentages of currently married men and women who were reported as temporarily absent are compared in Table 24, Panel B. Absences were more common for currently married males than for females in almost all age groups and for both the rural and urban portions of the sample. Unfortunately, from the existing tabulations it is not possible to know how many of the absent married women were married to the married men listed as absent. Undoubtedly some of the husbands and wives listed as absent from the household were spouses. Thus the proportion of husbands who were absent should represent a maximum estimate of the proportion of women who were separated from their spouses while the <u>difference</u> between the proportions of husbands and wives absent would represent a minimum estimate (since not all the wives who were absent were necessarily spouses of the married men who were absent). Thus for the rural sample, somewhere between 1.6 and 3.3 percent of currently married women in the household were temporarily separated from their husbands, while for the urban sample, somewhere between 0.9 and 2.6 percent were in that situation. Of course, if many absent spouses were not included as usual residents in the household by the respondents, even the maximum estimate may actually underestimate the extent of temporary separation.

The figures provided in Panel B suggest that there might be greater separation of spouses in rural than in urban areas, contrary to the results presented in Panel A. The approaches, however, are quite different and are by no means directly comparable. The results in Panel B refer only to spouses who are considered permanent residents of the household interviewed. If either a married woman or her husband or both are not considered to be usual residents of the household, their temporary separation would not be reflected. For example, if a woman is employed as a domestic servant and is separated from her husband, she would not report her husband as a usual resident of the household in which she is working or may indeed not be reported herself as a usual resident of that household, and thus their separation would not be reflected in the results in Panel B. For this reason, the actual proportion of women who have absent husbands in the overall population, and particularly the urban population, may be considerably higher than indicated through this approach.

Probably the single most important source of absences among rural spouses is circular migration, typically associated with temporary employment in some other location, often in an urban area. One recent study of circular migration in six villages in northeast Thailand by Lightfoot and Fuller (1981) provides additional information relevant to assessing the extent of temporary separation of spouses. Their study indicates that there is an important although not overwhelming seasonal component to circular migration, with the highest rates of absence occurring after the rice harvest and prior to the following planting season, although they point out that the temporal pattern of the migration is quite complex and not strictly related to the farming calendar. In this connection, it is worth noting that both the 1960 census and NS, the sources on which Panels A and B of Table 24 are based, took place during that part of the year when temporary absences would be expected to be highest.

While much temporary migration is among single persons and thus not relevant to the separation of spouses, data presented by Lightfoot and Fuller permit calculation of the percentage of married residents who were absent at least once during the three-year period under study. By comparing the results for men and women, some idea of the extent to which spouses were separated can be gained. As indicated in Panel C of Table 24, a far higher percentage

of married men have been absent during the three-year period than married women, thus suggesting at least some period of temporary separation. Rates of absences are inversely related to age, with far fewer absences indicated for men and women at age 50 and over. The data presented in their paper do not permit direct linking of husbands and wives, so we do not know what proportion of women in reproductive ages were married to men aged 50 or above who show the lower rates of absences. Judging from the fact that the difference between ages of spouses is typically not large in Thailand, it seems safe to assume that the vast majority of wives under 50 were married to husbands who were also under 50 and thus that the proportion of reproductive-age married women whose husbands were away at least once during the three-year period is quite substantial. Note should be taken, however, that respondents were classified according to marital status at the time of the survey and thus for those persons who married within the three-year reference period, some of the absences may have occurred while they were still single. Also, absences were liberally defined as any overnight absence, thereby maximizing the proportion who were absent at least once. Data on duration of absence indicate that many absences involved considerably longer stays than a single night. For example, 57 percent of all absences were a result of trips to Bangkok, and almost 70 percent of these visits lasted at least a month, with approximately 40 percent lasting more than three months at any one stretch. Moreover, a number of persons experienced more than one absence during the three-year period. Finally, it should be noted that the six villages under study were in a province characterized by unusually high migration rates.

In brief, the assorted information about temporary separation of spouses was sufficient to suggest that this factor may play a nonnegligible role in influencing Thai fertility levels, although it is not likely to be a dominant factor except perhaps under some special local circumstances.

NOTES

[1]While such a comparison eliminates the bias mentioned, it does not eliminate problems that could arise from differential reporting accuracy by age. Older married women would be recalling their age at an event

further in the past than younger married women and thus may be more prone to recall error, including digit preference. Although an association between age and extent of recall error does not automatically bias results, it potentially could. Other problems with this approach are discussed in Trussell (1980:12).

[2]According to a difference of means test (based on a simple random sample assumption), the differences between these two cohorts in NS and AFPH are not significant at the .05 level, while results for CPS2 are significant at the .001 level.

[3]The technique for calculating the singulate mean age at marriage based on the two censuses is also described in Chamratrithirong (1976) and United Nations (1982).

[4]For the purpose of this comparison, we calculated the age-standardized number of children ever born for all currently married women from figures given for currently married women with spouse present and with spouse absent separately in Goldstein et al. (1973). We simply weighted the results for each of the two categories in proportion to their relative numbers.

CHAPTER 4

PROXIMATE DETERMINANTS 2: THE CHILDBEARING SPAN AND NATURAL MARITAL FERTILITY FACTORS

Even in the absence of deliberate attempts at birth control, marital fertility of different populations can vary substantially. Bongaarts (1978) has grouped together a number of intermediate variables that can affect the level of marital fertility other than the practice of contraception and abortion and has labeled them "natural marital fertility" factors. In this chapter, we review three of those factors for Thailand: primary sterility, coital frequency, and the postpartum nonsusceptible period. We start out, however, with a review of evidence about the length of the biological childbearing span. This is not strictly a determinant of marital fertility per se since marriage and hence marital fertility typically begin sometime after the onset of menarche. Nevertheless, the topic fits into the general theme of this chapter. Moreover, the end of the childbearing span directly influences marital fertility at older ages and even the age of marriage may be loosely linked to the age at which reproductive capacity begins.

THE CHILDBEARING SPAN: AGES AT MENARCHE, MENOPAUSE, AND LAST BIRTH

The reproductive spans of men and women are ultimately limited by biology. Since the ages at which women are capable of reproducing generally fall within a narrower and more clearly defined range, most research in Thailand and elsewhere has focused on the limits of the female reproductive span. The onset of menarche and menopause clearly represent the outside limits of a woman's potential reproductive years. In actuality, the physiological ability to bear a live birth typically

begins sometime after menarche, as reflected in the well-known concept of "adolescent sterility" (or more accurately, adolescent subfecundity). Likewise, the ability to bear a live birth typically ends sometime before the onset of menopause (Gray, 1976, 1979a). As difficult as it is to accurately measure the average age of menarche and menopause in a population, it is all the more difficult to measure the average age at which the ability to reproduce actually begins and ends. The age of mother at last birth among women past the end of the childbearing span can give us an indication of the latter in predominantly natural fertility populations.

There are several studies that provide some indication of the age of menarche in Thailand. The results are summarized in Table 25. None of the studies are based on a representative national cross-section of the Thai population but rather on regional or specialized samples. Comparisons across studies are further limited by the necessity to impose different restrictions on the cases included in the calculations in order to ensure comparability within each study when internal comparisons are possible. A particular problem when evaluating results of studies on retrospectively reported ages at menarche is the possibility that the results suffer from "censorship" bias when some of the respondents are younger than the latest age at which menarche can occur. The problem is similar to that discussed in connection with respect to age at first marriage in Chapter 3. Only women who have already experienced menarche can report on an age at menarche, and thus responses for women who experience menarche at early ages are disproportionately represented among women who are below the latest age at which menarche occurs. The result of such censorship is to bias the estimated age at menarche downward.

Presumably the onset of menarche was left to be defined by the respondent, and responses were given directly in terms of age. Since Thais appear as likely to report ages in terms of age at next birthday as they are to report age at prior birthday, the average age at menarche of women reporting age x is probably exactly x rather than x plus one half year, as would be the case if they were reporting their age at prior birthday (see Chapter 2, footnote 4). Because of this tendency for Thais to round their age to the nearest birthday, no adjustment has been made for converting stated age to exact age when calculating the mean and median ages at menarche.

TABLE 25 Reported Age at Menarche from Selected Studies: Thailand

Date of Study	Source	Reference Population	Age at Menarche: Mean	Age at Menarche: Median	Number of Cases
1977	A	Currently married women 15-49 in northeast	15.8	--	7,850
1977-78	B	Once-married women 15-54 in Chiang Mai Valley, northern Thailand	15.8	--	ca. 305
1952-54	C	Reproductive-aged women in village near Bangkok	15.3	14.7	94
1978-79	D	Ever-married women 20-44			
		Bangkok general sample	14.1	14.6	497[a]
		with 0-4 years of school	14.3	14.9	334
		with 5+ years of school	13.4	13.9	160
		Bangkok slum sample	14.2	14.7	461[a]
		with 0-4 years of school	14.2	14.7	427
		with 5+ years of school	14.4	15.1	33
		Central Thai village, relatively developed	14.2	14.6	612[a]
		with 0-4 years of school	14.1	14.6	527
		with 5+ years of school	14.1	14.5	81
1979	E	Bangkok massage girls	14.4	15.0	992
1943-64	F	Bangkok medical students	13.1	13.6	331

1978	G	Single women 15-20 who experienced menarche under age 15			
		Bangkok school girls	12.5	12.9	169
		Bangkok factory workers	13.2	13.5	84
		northeast school girls	12.8	13.2	157
		northeast factory workers	13.2	13.5	60
?	H	Bangkok hospital outpatients and others			
		born 1923-27	15.1	--	--
		born 1953-57	13.6	--	--

Note: In some cases means or medians were calculated or recalculated based on data presented in source rather than being directly taken from source.

[a]Includes some women of unknown educational attainment.

Sources:
A Porapakkham and Bennet (1978:78).
B Cochrane and Nandwani (1981:Table 2).
C Hauck (1956:30).
D Chamratrithirong (1982).
E Muangman and Nanta (1980:47).
F Bhumipadhi (1965:521).
G Muangman (1979:55)
H Trisiripisarn et al. (1974:92).

The first study reported is based on the FPHH survey and involves by far the largest number of respondents. Moreover, it is representative of the widest population of all the studies shown, since the sample was intended to be more or less representative of the entire northeastern region. The mean reported age of menarche, close to 16, is relatively late compared to the 12 to 13 years typical of industrialized countries and of several developing countries with presumed high standards of health, such as Cuba (Gray, 1979b).

This late age at menarche is confirmed by the second set of results, which come from another recent study based on a much smaller sample of women from 22 villages in the Chiang Mai Valley in northern Thailand. In both the FPHH and the Chiang Mai samples the proportions of women who were under age 20 were quite small--5 percent and 3 percent, respectively--so the results suffer very little from the censorship bias referred to above. Moreover, since censorship biases the estimates toward a younger age, it cannot help explain the rather late mean ages of menarche indicated. The Chiang Mai Valley Study examines the relationship between age at menarche and age at marriage. Interestingly, the results show a significant positive association between the two in a multivariate regression analysis (Cochrane and Nandwani, 1981).

A slightly younger mean age of menarche is indicated in the third set of results, based on a small study conducted in the early 1950s in a village about 20 miles from Bangkok. Again, any censorship bias should be small since women within the entire reproductive span were interviewed, although insufficient detail is provided to judge what proportion were still in adolescent ages. The study also involved clinical examinations and the investigator noted that none of the girls between ages 12 and 14 examined had passed menarche (Hauck, 1956).

The fourth set of results (D in Table 25) is based on the Asian Marriage Survey (AMS) and refers to the three subsamples included: a representative sample of evermarried women in the reproductive ages in Bangkok generally, in a slum area of Bangkok, and in a relatively developed village in the central plains. Since virtually all women reported experiencing menarche prior to age 20, calculations were based on women aged 20 through age 44, the age of the oldest woman included in the sample. Both the median and mean age at menarche are very similar across all three subsamples, falling between 14 and 15 with the mean approximately a half year higher than the

median. These figures are younger than those for the northeastern and Chiang Mai samples but agree rather closely with the following set of results from a study of Bangkok massage girls. While no age restrictions were imposed on the sample of massage girls, only 15 percent were under age 20 and undoubtedly most of these were in their late teens (Muangman and Nanta, 1980).

There is considerable evidence suggesting an inverse association between nutritional status and the age at menarche (Gray, 1982). This might account for the somewhat later age at menarche indicated for Thailand in comparison to the more industrialized countries. Possibly the later ages at menarche reported for the northeastern region, the poorest in the country, and the Chiang Mai villages, compared to the AMS subsamples can also be interpreted in this way. Other evidence from Thailand indicates an inverse association between socioeconomic status and average age at menarche, which could be attributable to nutritional or health differences. Data from the AMS subsamples are shown subdivided by educational attainment of respondents. Presumably the better educated women are on average from better backgrounds and were probably better nourished in their youth. In the general Bangkok sample, women with five-plus years of schooling reported experiencing the onset of menarche approximately one year earlier than those with less schooling. The same difference does not show up for the other two subsamples, but this may partially reflect the smaller sample sizes of better educated women in the Bangkok slum and the semi-rural areas.[1]

The lower age at menarche found for female medical students, the next set of results shown, compared to the massage girls or the three subsamples in the AMS is also suggestive of the influence of nutrition and health, since the medical students surely come from relatively higher socioeconomic backgrounds. Some of the difference, however, could be due to differences in the way age is stated (there may be less rounding of age among the university-educated population) and possibly to censorship of the sample if not all of the students had yet experienced the onset of menarche. No information on this latter point was provided in the published results of the study.

The results based on nonrepresentative samples of schoolgirls and adolescent factory workers in Bangkok and a provincial town and peri-urban area in the northeast region (set G) also point to an inverse association with

socioeconomic background. Since the age distributions of the samples of schoolgirls and factory workers were quite different, it was necessary to restrict calculations to girls 15 or over who had experienced menarche prior to age 15 to avoid differential truncation biases. Because of these restrictions, the results show very early ages at menarche and cannot be compared directly with results from other studies. The internal comparisons, however, are of interest and indicate an earlier age at menarche for the schoolgirls than for factory workers. Since the schoolgirls came from higher socioeconomic backgrounds (Muangman, 1979), this finding is consistent with the suggestion that nutritional status is exerting an influence on the onset of menarche.

There is substantial evidence that the age at menarche in Western societies has declined by about three years since the end of the last century (Bongaarts, 1980a; Wyshak and Frisch, 1982; see, however, Bullough, 1981). It is generally agreed that this decline is associated with an improvement in diet and nutritional status. The final set of results in Table 26 come from a study of a nonrandom sample including a substantial number of outpatients from a Bangkok hospital, which also suggests a decline in the age at menarche. According to this study, the mean age at menarche fell from just over 15 for women born in 1923-27 to less than 14 for women born in 1953-57. These results, however, must be viewed with considerable caution. Only a preliminary report of the study with few details has ever been published. Since it seems likely, judging from the date of the study, that not all members of the younger cohort would have

TABLE 26 Mean Age at Menarche by Age and Residence, Currently Married Women Aged 20-44: Thailand

	Total		Bangkok General		Bangkok Slums		Semi-Rural Area	
Age Group	Mean	N	Mean	N	Mean	N	Mean	N
20-24	14.2	283	14.2	65	14.3	115	14.1	103
25-29	14.6	390	14.4	140	14.8	113	14.6	137
30-34	14.7	310	14.5	109	14.8	79	14.8	122
35-39	14.7	292	14.8	92	14.9	77	14.6	123
40-44	14.9	294	14.9	91	15.0	77	14.8	126

Source: Chamratrithirong (1982).

experienced menarche at the time the data were collected, the lower age at menarche for the 1953-57 cohort may result from basing the calculations on a censored sample. In addition, the extent and direction of recall error might differ among younger and older women as might also the composition of the different cohorts with respect to other characteristics associated with the onset of menarche.[2]

Data from the AMS can be examined for evidence of trends by comparing the mean age at menarche for different age cohorts. To avoid any bias due to censorship, the analysis was restricted to women aged 20 or over. The results, shown in Table 26, also suggest that the mean age at menarche has declined in Thailand in recent years. For the combined set of three subsamples, an almost uninterrupted fall from 14.9 to 14.2 years of age is indicated for successively younger age cohorts. The median age at menarche (not shown) also declines steadily from cohort to cohort, from 14.3 to 13.8. Indeed, similar trends are evident for each of the subsamples, with only minor irregularities apparent. In each subsample, as in the total sample, the mean age at menarche decreases by 0.7 years between the oldest and youngest age group. A similar tabulation of mean age at menarche by current age from the Chiang Mai Valley Study also indicates a rise with age and thus is consistent with a decline over the last generation. Women aged 45-54 reported a mean age at menarche just over 16, while women 20-24 reported menarche occurring about a year earlier (Cochrane and Nandwani, 1981).

The results from the AMS and the Chiang Mai Valley Study indicating a decline in age at menarche should be viewed with caution, since they are based on retrospective reports and are subject to recall error, which might well differ in extent and direction for different age groups. Moreover, they refer to specialized samples which cannot be generalized to the national population without serious reservations. Nevertheless, they are at least suggestive of a decreasing age at menarche in Thailand.

Information on the age at menopause in Thailand is scarcer than that on age at menarche. The study based in part on Bangkok hospital outpatients (referred to above and in Table 25) is the only one we have been able to locate purporting to have such data. The results indicate an increase in the mean age at menopause from 44.7 for women born in 1898-1903 to 48.1 for women born

in 1913-1917 (Trisiripisarn et al., 1974). This is a striking increase over such a short period of time, but due to lack of details in the preliminary report, it is difficult to assess the reliability or validity of these findings. According to the report, the results for both the age-at-menarche and the age-at-menopause data are based on a total of 1,000 cases. It is not clear, however, how many women served as the basis for the results for each cohort.

Gray (1979a, 1979b) has summarized results from a number of studies on the age at menopause in different countries. He finds considerable consistency in the mean age at menopause among recent studies of Caucasian women, with results falling in the narrow range of 48.7 to 49.8. However, studies for populations in developing countries indicate median ages at menopause as low as 44 in the Punjab in 1966 and 43.6 among malnourished women in New Guinea in 1973. Thus the figures provided by the Thai study fall within the ranges found in other studies, with the higher estimate for the more recent cohort approaching the mean age at menopause in Western countries.

Although the FPHH survey of northeastern women could not collect data on actual ages at menopause, since the sample was largely premenopausal, it did include a question about the age at which the respondent expected a normal woman to have menopause. The average age mentioned was 48.8, indicating that the women do not think menopause is particularly early in Thailand (Porapakkham and Bennett, 1978:74).

While menopause marks the termination of a woman's reproductive life, the onset of secondary sterility and thus the effective end of a woman's ability to reproduce occurs somewhat earlier. A variety of studies in populations thought to be characterized by natural fertility suggest that the mean age at last birth, a more meaningful measure of the end of a woman's fertile period, is close to 40 (Bongaarts, 1980a; van de Walle and Knodel, 1980). In populations where a significant amount of birth control is practiced, the average age at last birth can no longer be accepted as an indication of the age at which women lose the ability to bear children. Even in some populations where there is an absence of deliberate behavior to limit family size, social customs might dictate terminal abstinence associated with attainment of grandmaternal or mother-in-law status (Knodel, 1982). In such circumstances, the mean age at last birth would reflect the socially defined, if not physiologically defined, end of reproductive ability.

TABLE 27 Attitudes Regarding When Women Should Cease Sexual Relations as Reported by Ever-Married Women Aged 15-44: Thailand

		Bangkok General	Bangkok Slum	Semi-Rural
Percent indicating women should cease sex by menopause		69.5	83.4	81.6
	N	514	507	657
Percent indicating women should cease sex relations prior to age[a]:				
	40	3.8	2.7	3.6
	45	27.8	31.3	33.1
	50	44.8	50.2	43.0
	N	446	438	589

[a]Excluding respondents coded as don't know, no answer, or depends.

Source: Chamratrithirong (1982).

For Thailand, there is a notable absence of references to the practice of terminal abstinence associated with becoming a grandmother or mother-in-law, and thus we suspect no such social custom operates in Thailand. The AMS, however, included several questions on attitudes toward when women should cease sexual relations. Ever-married women in their reproductive ages were asked specifically whether a woman should cease having sex relations by the onset of menopause as well as the age at which they thought a woman should cease sex relations. Results are presented in Table 27. In all three subsamples, the large majority of respondents agreed that the woman should cease sex relations by menopause, although the proportion in the general Bangkok sample was considerably lower than in either the Bangkok slum or the semi-rural area. When asked at what age women should cease having sexual relations, over 40 percent replied age 50, and almost as many replied either age 40 or 45, most likely reflecting the age at which they assumed a woman reaches menopause. Given that very few women feel that sex relations should stop before age 40 or even before age 45, terminal abstinence would seem to exert little influence on reproductive behavior in Thailand. Such a conclusion must be stated cautiously, however, since these data are attitudinal and may not reflect actual practice of terminal abstinence. It would be

useful to attain behavioral data on the age at which women cease sex relations as well as the extent to which this is linked to menopause or to their own children starting families.

Since very little contraception was practiced among married women at the time of the first round of the Longitudinal Study and only two of the more than 300 women aged 45 or older indicated they had ever practiced contraception, it is possible to treat these women as if they came from a natural fertility population. The average age at which these women bore their last child should therefore reflect the effective end of the child-bearing span as determined by fecundity in combination with coital frequency (since some couples will undoubtedly be abstinent even in the absence of any normative proscription on intercourse associated with age or stage of family cycle). Due to the coding procedures followed, women whose last birth occurred after age 45 must be excluded from the analysis. This leads to a slight downward bias in the age of mother at last birth compared to what the results would be if all women were included. By comparing successive age groups above age 45, it is possible to determine whether there appears to be a trend over time in the average age at last birth. Results are presented in Table 28 for women aged 45 and above. Some widowed, divorced, or separated women experienced marital dissolutions prior to age 45, potentially biasing down-

TABLE 28 Age of Mother at Last Birth Prior to Age 45, Among Rural Currently Married and Ever-Married Women, Aged 45 and Above, Whose Last Birth Occurred Prior to Age 45: Thailand

Age at Survey	Currently Married Women			Ever-Married Women		
	Mean	Median	N	Mean	Median	N
45-49	38.0	39.4	112	37.6	38.7	139
50-54	37.8	38.3	67	37.5	37.2	80
55-59	38.6	39.5	37	38.3	39.1	62
60-64	36.8	40.0	15	37.0	39.5	22
65+	37.9	40.5	14	38.3	40.5	20
All women 45+	38.0	39.1	245	37.7	38.8	323

Source: LS1.

ward the age at last birth for ever-married women. Since this appears to be a minor problem, however, and the number of cases, particularly for women at older ages, is so small, results for ever-married women are shown along with those for currently married women. Given the downward bias due to the omission of women whose last birth occurred after age 45, the overall results indicate an age of mother at last birth reasonably close to that in other natural fertility populations. Of greater interest is the lack of any apparent trend over time in the age of mother at last birth, although the small number of cases, particularly at older ages, and the somewhat different pattern of fluctuations based on the mean and median preclude any definitive conclusions in this respect.

PRIMARY STERILITY

In any population, at least a small proportion of couples are unable to bear any children because of physiological impairment of either or both of the spouses. If we assume that voluntary childlessness is negligible in Thailand, then the extent of primary sterility (the inability to bear any children) can be approximated by the proportion of ever-married women who remained childless to the end of the reproductive age span. The results presented in Table 29 indicate primary sterility in Thailand is quite low in any absolute sense. Among ever-married women aged 45 or above, less than 4 percent in the 1960 census and only about 2 percent in the 1970 census reported never having had a live birth. This indicator should be taken only as a rough estimate of primary sterility and could either overstate or understate the true level, since biases are operating in both directions. For example, to the extent some couples deliberately remain childless, we would be overestimating the extent of biological sterility. In addition, while the slight rise with age in the percent childless apparent in both the 1960 and 1970 censuses might reflect a decline over time in primary sterility, it could also reflect an increased tendency for older women to underreport births and, especially if all their children died, to report no children ever born, hence biasing the estimate of childlessness upward. Moreover, the percent childless only reflects primary sterility as existing at the time a woman first begins cohabiting, leaving open the question of whether the woman or her husband were previously fecund.

TABLE 29 Percent Childless and Percent with Unknown Number of Children Ever Born Among Ever-Married Women Over Age 45, by Age: Thailand

Age	1960 Census		1970 Census	
	Percent Childless[a]	Percent Unknown	Percent Childless[a]	Percent Unknown
45-49	3.2	3.5	1.7	3.6
50-54	3.5	3.9	1.8	4.1
55-59	3.8	4.5	2.0	4.6
60-64	4.2	5.6	2.5	
65-69	4.2	6.8	2.5	7.2
70+	4.0	8.9	2.5	
45+	3.7	5.0	2.1	5.2

[a]Excluding from the denominator women with unknown number of children ever born.

Other influences could result in this measure understating the level of primary sterility. There is reason to suspect that a disproportionate number of women classified as having an unknown number of children ever born are in fact childless. This situation could arise if there were a tendency for enumerators to leave a blank space or enter only a dash on the census questionnaire instead of entering a zero for women who stated they had no children. In data processing, these responses are likely to be treated as indicating an unknown number of children. Such a pattern has been noted for a number of censuses (El-Badry, 1969) as well as for the 1960 Thai census (Goldstein, 1970:327-338). Thus some proportion of the percent of women listed as having an unknown number of children ever born should be included with the percentage childless. Since the increase in this percentage after age 45 probably reflects a genuine increase in the proportion of women who do not remember the number of live births they had, the percent with an unknown number of children ever born among women 45-49 represents the maximum extent of misclassification. Indeed, it would undoubtedly be an exaggeration to assume that all of these women were actually childless. However, even if they were, the extent of primary sterility would still not be extremely high. In this connection, it is interesting to note that the proportion childless among

the more than 400 ever-married women aged 45 and above included in the rural round of LS1 was only 3.2 percent (and only 2.3 percent among the 171 ever-married women aged 45-49, for whom memory error is probably less). It seems much less likely that the Longitudinal Study would have misclassified many childless women as having an unknown number of children ever born, since detailed pregnancy histories were called for and the very few cases of women with an unknown number of children ever born were largely limited to older women, for whom recall problems seem more plausible.

Despite the variety of biases operating on the percent childless as a measure of primary sterility, we believe it is safe to conclude that primary sterility in Thailand has been low and not far from the 2- to 3-percent level. We are much more hesitant to draw conclusions about trends in primary sterility from the existing data other than to mention that to the extent the data suggest a trend, it is toward a decline. It is possible, however, that an increase in primary sterility could occur in the future as a result of an increase in venereal disease, especially in urban areas.

There is considerable concern in Thailand about a potential increase in the incidence of both syphilis and gonorrhea, since statistics indicate sharp increases in the reported cases treated, rising fairly steadily from 10 per 100,000 population in 1950 to 24 in 1975-77 for new cases of early syphilis, and from 9 per 100,000 in 1950 to 647 in 1975-77 for gonorrhea (Limanonda and Suwannodom, 1979). Of relevance for primary (or secondary) sterility, of course, is the overall prevalence of venereal disease, not just the incidence of treated cases, and the extent to which cases receive early treatment. Such statistics are not available. Apparently in the early 1930s, venereal disease was rare. According to Zimmerman (1931:229-300), careful physical examination by government physicians of about 10,000 people located in groups of 250 in 40 representative areas revealed virtually no venereal disease outside the large market places or port cities. The sharp rise in treated cases, especially for gonorrhea, would seem to point to some increase in general prevalence. Pathological levels of primary sterility associated with venereal disease are known to characterize some parts of tropical Africa as well as some New Guinean populations and to exert an important influence on their fertility (Gray, 1982; Knodel, 1982). Thus the potential for an increase from

the low levels of primary sterility currently characterizing Thailand appears real if the alleged increase in venereal disease really exists and contributes.

COITAL FREQUENCY

One of the proximate variables for which reliable and representative information is rarely available for most populations is coital frequency (Nag, 1982). Table 30 summarizes results of four studies that provide information on this variable for Thailand. Three of the four

TABLE 30 Reported Weekly Coital Frequency from Selected Studies: Thailand

Part A. Among currently married respondents in a national rural sample, by age and sex, 1975

Weekly Frequency	As Reported by Married Male Respondents			As Reported by Married Female Respondents			Both Sexes
	15-34	35+	Total	15-29	30-44	Total	
3+	45.9	13.7	29.0	41.0	15.1	25.6	27.9
2	23.3	15.9	19.3	29.3	19.8	23.5	20.7
1	22.6	26.2	24.4	18.6	24.1	21.4	23.4
Less than 1	8.3	44.3	27.3	11.2	40.9	29.4	28.0
Total Percent	100	100	100	100	100	100	100
Mean	2.6	1.3	1.9	2.5	1.4	1.9	1.9
Median	1.8	0.6	1.0	1.7	0.7	1.0	1.0
N[a]	412	454	869	188	232	429	1,298

Part B. Among male clients at family planning clinics of Chulalongkorn Hospital, Bangkok, by age and vasectomy status, 1976-78

Weekly Frequency	Vasectomized Men				Nonvasectomized Men				All Men
	15-29	30-39	40+	Total	15-29	30-39	40+	Total	
5+	18.0	14.3	11.7	14.2	9.0	9.4	6.2	8.8	11.5
3-4	34.4	33.2	38.3	34.6	43.0	33.3	27.7	34.8	34.7
1-2	44.3	47.1	42.6	45.5	42.0	51.7	50.8	49.1	47.3
Less than 1	3.3	5.5	7.4	5.6	6.0	5.6	15.4	7.3	6.4
Total percent	100	100	100	100	100	100	100	100	100
Mean	3.0	2.8	2.7	2.8	2.7	2.5	2.2	2.5	2.6
Median	1.6	1.4	1.5	1.5	1.6	1.4	1.2	1.4	1.4
N	61	238	94	393	100	234	65	399	792

studies are based on quite specialized samples and, as discussed below, the results appear to be quite sensitive to the type of question asked.

The most representative sample for which coital frequency data are available comes from the 1975 Westinghouse Rural Population Survey, which included rural

TABLE 30 (continued)

Part C. Among men vasectomized at Ramathibodi Hospital, Bangkok, prior to and subsequent to the operation, 1974-76

	Pre-Operative	Post-Operative
Mean	2.1	2.5
Median	1.8	1.8
N	463	464

Part D. Among currently married women aged 15-44, in a Bangkok suburb by contraceptive practice status, 1967-69

Frequency in Week Prior to Interview	Practicing Contraception	Not Practicing Contraception	Total
4+	6.1	7.0	6.7
3	10.7	9.6	10.1
2	17.4	14.4	15.5
1	35.7	30.7	32.6
0	30.1	38.2	35.6
Total percent	100	100	100
Mean	1.3	1.3	1.3
Median	0.6	0.4	0.5
N	345	570	915

Notes: Part A: Respondents coded "no answer" are excluded. Mean and median calculated on assumption that the "less than 1" category equals 0.5 and "3+" category equals 4.0.

Part B: Respondents with unknown coital frequency are excluded. Mean and median are calculated on assumption that the "less than 1" category equals 0.5, the "1-2" category equals 1.5, the "3-4" category equals 3.5, and the "5+" category equals 6.0.

Part C: Respondents coded unknown were excluded. The mean and median were calculated by dividing the monthly mean and median by 4.3.

Part D: Respondents with unknown coital frequency are excluded. Mean is based on disaggregated frequencies in "4+" category.

[a]Figures refer to weighted Ns and thus do not sum exactly to total.

Sources: Part A: WRPS (Deemar Company, Ltd. [1975, Vol. 2:Table 15]).
Part B: Popuang (1980:Tables 18 and 19).
Part C: Sethaput and Leoprapai (1977:Table 25).
Part D: Muangman et al. (1973).

respondents in all four major regions. Since this survey included both men and women, it is possible to examine responses by sex of respondent. The results do not support the idea that men exaggerate and women minimize coital frequency, as is sometimes expected. As indicated in Panel A, married men and women reported remarkably similar frequencies of intercourse. Both sexes indicated a mean weekly frequency of 1.9 times and a median of once a week. As would be expected, coital frequency is inversely related to age, with substantial differences indicated between the younger and older portions of the sample.

A less striking though similarly inverse relationship with age is indicated in Panel B based on a specialized study comparing coital frequency among vasectomized and nonvasectomized men receiving services through a Bangkok hospital. The overall coital frequency, whether measured by mean or median, is somewhat higher for both the vasectomized and nonvasectomized men in this study than was indicated by the results for the rural sample in Panel A. Likewise, results from a different study of men receiving vasectomies at another Bangkok hospital, presented in Panel C, indicate that both pre-operative and post-operative rates of coital frequency are also somewhat higher than for the rural sample. In both of these Bangkok studies, the reported mean coital frequency was between two and three times a week and the median between one and two times a week. It is not clear in these studies whether men were reporting only coital frequency with their wives or also included sexual relations with prostitutes. This might account for the difference between the coital frequency rates reported by the Bangkok sample and the rural sample, although undoubtedly many other factors could also influence the results.

The results in Panel D are based on a study in Bangkhen, a Bangkok suburb, and are of particular interest both because the respondents were women and, more importantly, because the data were elicited by what appears to be a different methodology for determining coital frequency. Presumably in the other three studies, respondents were asked a general question on coital frequency rather than one that specifies a particular reference period. In the study summarized in Panel D, respondents were given an envelope containing a card listing the days of the week and were asked to mark the days of the previous week on which they had sexual

relations with their husbands. They were then asked to put the card back in the envelope and return it to the interviewer. This approach has both the advantage of privacy and the fact that it has a concrete period of reference. It does not, however, permit a respondent to indicate more than one act of coitus in any given day. Results were tabulated according to whether or not the women were practicing contraception.

The most striking features of the results in Panel D are the considerably lower rates of coital frequency compared to other studies. Indeed, around a third of the women indicated that they had not had intercourse in the previous week. Quite likely a considerable share of those not having intercourse were experiencing menses. At least one anthropologist indicates that intercourse during menstruation is generally avoided (Mougne, 1978). In addition, about 12 percent of the respondents indicated their husbands had not been home during the reference week (Udry et al., 1982).[3] Given the very different nature of the samples on which these studies are based, it is not possible to say definitively that the difference in methodology accounts for the lower rates of coital frequency reported in the Bangkhen study, but such an explanation is certainly plausible.

BREASTFEEDING PATTERNS AND THE POSTPARTUM NONSUSCEPTIBLE PERIOD

Among the most important determinants of fertility in the absence of deliberate birth control are lactation practices. The contraceptive effect of breastfeeding is well documented (McCann et al., 1981). Prolonged lactation protects against pregnancy by delaying the postpartum return of ovulation and thus extends the period of nonsusceptibility to conception following a birth. Changes in breastfeeding practices can therefore have a significant effect on fertility trends.

Information on the prevalence and trends in breastfeeding practices are available from several of the national sample surveys. A recent study that extensively analyzed these data has clearly documented a moderate and relatively steady decline in the duration of breastfeeding during the same period that fertility has been declining (Knodel and Debavalya, 1980). The results, summarized in

Table 31, and Figure 4 indicate that sharp rural-urban differences in breastfeeding persisted throughout the period while parallel declines took place in urban and rural areas. In either case the estimated mean duration of breastfeeding fell by almost five months. The evidence on changes in the prevalence of breastfeeding is less clear as measured by the percentage of last-born children who were never breastfed. The data indicate that breastfeeding is almost universal in rural areas, although the prevalence may have declined slightly over the last few years. Even in urban areas, three fourths of last-born children were breastfed for at least a short period of time.

Additional information on breastfeeding is provided by CPS2, taken in 1981. Since information on breastfeeding was asked only of women who had a surviving birth during the two years prior to the survey, indexes comparable to those presented in Table 30 cannot be calculated. However, a rough comparison of the percent of women still breastfeeding their most recent birth can be made with results for NS, which took place in 1978, by also restricting the calculations for NS to women with a birth

TABLE 31 Indexes of Breastfeeding from Selected Surveys, 1969-79: Thailand

	Rural				Urban			
Index	LS1 1969	LS2 1972	SOFT 1975	NS 1979	LS1 197[illegible]	LS2 1973	SOFT 1975	NS 1979
Percent still breastfeeding[a]	72.4	71.0	67.2	55.6	41.6	30.9	31.3	25.8
Mean duration of breastfeeding per child (months)[b]	22.4	22.0	20.9	17.5	12.9	9.9	9.7	8.4
Percent of last-born child never breastfed	--	--	6.4	9.6[c]	--	--	25.8	24.4[c]

-- indicates information not available.

[a]Among nonpregnant women with a child under 3. Standardized for months since last birth by applying equal-weights standardization procedure to results tabulated by successive categories of 4 months duration each.
[b]Based on proportions still breastfeeding by age of child in months.
[c]Standardized for age of mother using the age distribution of respondents to the equivalent question in the equivalent residence category in the SOFT sample.

Source: Adapted from Knodel and Debavalya (1980).

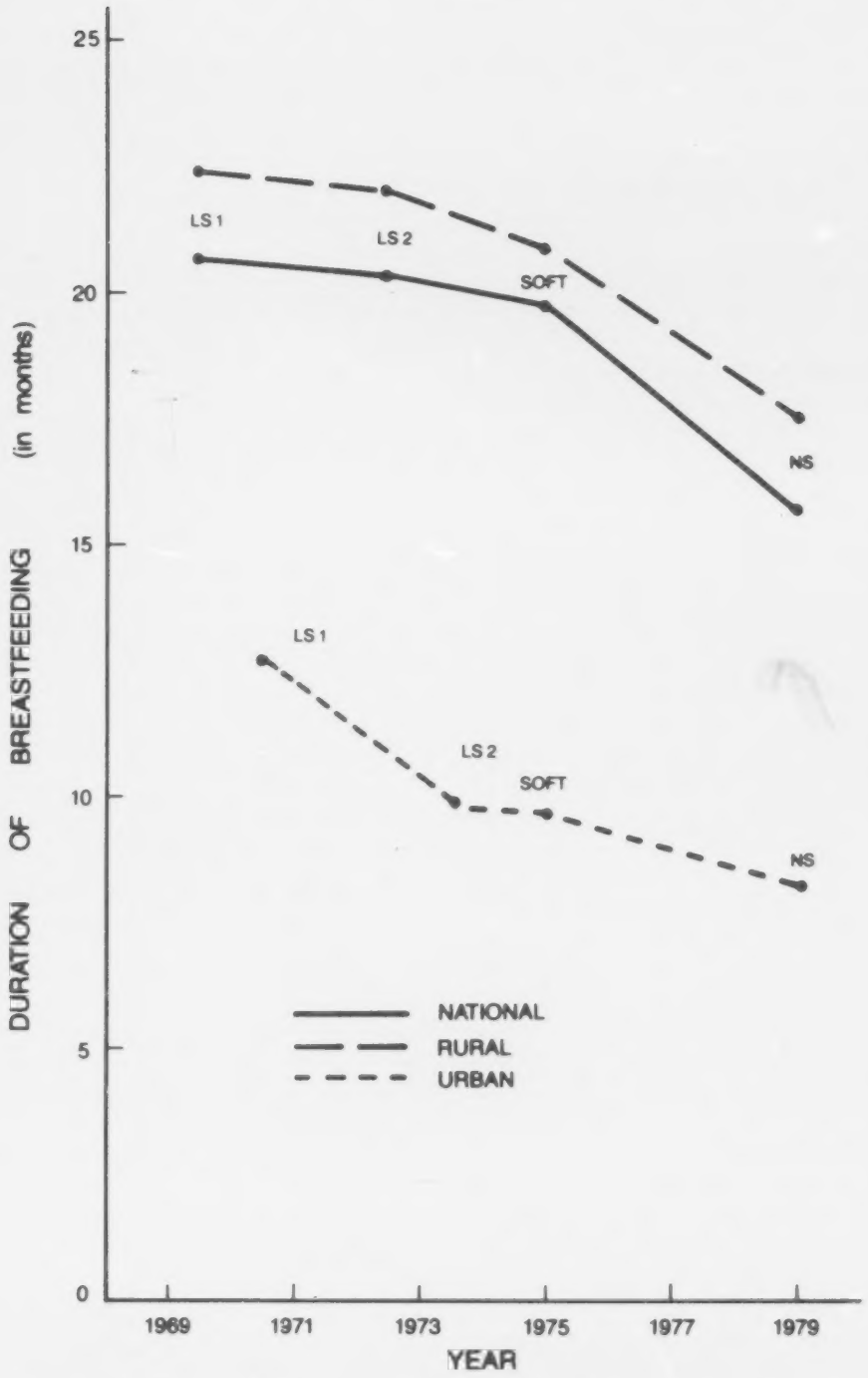


FIGURE 4 Mean Duration (in months) of Breastfeeding from Selected Surveys, 1969-70 to 1979: Thailand

in the two years prior to interview. After standardization for months since last birth, the resulting calculation indicates 67 percent of rural women still breastfeeding in NS and 66 percent two years later in CPS2, while for urban women the comparable figures are 36 percent still breastfeeding for NS and 34 percent for CPS2 (Knodel et al., 1982). Since the CPS2 calculations are restricted to women with a surviving child while NS calculations are not, the CPS2 figures probably overstate to a small extent the percent of women still breastfeeding relative to the NS results and thus understate slightly an apparent continuation of a decline in breastfeeding between the two surveys.[4]

In addition to collecting information on breastfeeding in general, CPS2 contained questions about when non-milk foods were first fed to the child and about how long ago the respondent experienced her last menstrual period. These data from CPS2 provide the basis not only for estimating the median duration of any breastfeeding but also a rough approximation of the median duration of "full" breastfeeding and of postpartum amenorrhea. Moreover, while CPS1 included no questions on breastfeeding, it does provide data on how long ago the respondent experienced her last menstrual period and also can be used to calculate duration of postpartum amenorrhea. Results are presented in Table 32.

In general, the results for CPS2 confirm those from earlier surveys in indicating that the vast majority of both rural and urban women breastfeed their children for at least some period of time. The percent of mothers who never breastfed based on the CPS2 data differ from those presented for earlier surveys in Table 31 inasmuch as they are based only on surviving births and are limited to the most recent birth during the last two rather than three years. The exclusion of nonsurviving births probably lowers the estimate of the percent of mothers who never breastfed their most recent birth, since deceased children are less likely to have been breastfed. In addition, sampling error, especially for relatively small urban portions of the samples, also contributed to differences in the sets of estimates, which argues against treating the comparison as an indication of trends. Hence, while it is possible that the higher prevalence of breastfeeding in urban areas indicated by CPS2 compared to NS may reflect a general increase between 1979 and 1981, we do not feel that firm conclusions can be drawn from a comparison of the two surveys.

TABLE 32 Indexes of Breastfeeding Among Women with a Surviving Birth in the 24 Months Prior to 1981 Interview and Estimated Median Duration of Postpartum Nonsusceptibility, 1978-79 and 1981: Thailand

Index	National	Rural	Urban
Percent never breastfeeding	9.1	7.5	16.7
Median duration of breastfeeding (in months)[a]	16.6	18.5	4.0
Median duration of "full" breastfeeding by women who start breastfeeding (in months)[b]	2.1	2.0	2.6
Median duration of postpartum non-susceptibility (in months)[c]			
1978/79	4.9[d]	6.0	2.1[d]
1981	4.7	5.1	3.1

[a]Includes women who never breastfed as duration 0.
[b]Derived by life table techniques.
[c]Estimated from data on time since last menstrual period.
[d]Excluding provincial urban

Source: Adapted from Knodel et al. (1982).

The CPS2 results confirm that rural Thai women breastfeed for much longer durations than their urban counterparts. Indeed, the results indicate that half of rural mothers breastfeed their surviving children for at least a year and a half, compared to only four months for urban mothers. The results on duration of breastfeeding from CPS2, however, cannot be compared directly to those presented for earlier surveys, both because the CPS2 results are for medians rather than means and refer to women rather than to children.[5]

When we focus on the median duration of full breastfeeding, a considerably different picture emerges. Since the information on the introduction of supplemental foods is limited to non-milk foods and ignores the possibility that some mothers may have provided their infants with commercial milk products at an even earlier age, the duration of full breastfeeding may be somewhat overestimated from the present data. To underscore the qualified definition of full breastfeeding, the term has been placed in quotation marks in Table 32. The striking feature of the estimates of full breastfeeding is the very short duration that they indicate, despite the possibility that these estimates may overstate its

extent. Clearly, women who breastfed their children introduced non-milk foods into the diet very early. This is true of both rural and urban women. Indeed, the estimated duration of full breastfeeding is slightly shorter for rural than for urban mothers. Findings from a 1979 survey done by Deemar Company under commission from several companies producing infant formula are quite consistent with the CPS2 results in indicating an early introduction of supplemental feeding and the lack of sharp differentials. According to the the Deemar findings, which were based on a random sample of mothers with infants under age 1, over 80 percent of mothers in both Bangkok and rural central Thailand had fed their infants non-milk foods before the age of four months regardless of social class (Gaither International, 1980:29).

The main interest in infant feeding practices for the study of fertility lies in the now well-established relationship linking prolonged lactation with delaying the return of ovulation and thereby extending the postpartum nonsusceptible period during which the woman is usually amenorrheic (Van Ginneken, 1978). Direct information on postpartum amenorrhea in Thailand is rare. Based on a retrospective survey conducted during the 1960s of women delivering in a number of Bangkok and regional hospitals, the mean duration of postpartum amenorrhea was estimated as six months (Van Ginneken, 1974). The sample, however, was clearly nonrepresentative as indicated by their reported mean duration of lactation of 12 months, undoubtedly below the national average at the time. This is not surprising given the probable overrepresentation of urban women in the sample compared to the national population.

More recent indirect estimates of postpartum nonsusceptibility are possible based on information collected in CPS1 and CPS2 on how long ago the respondent experienced her last menstrual period.[6] These estimates have the advantage of being based on representative samples. The striking feature of these results is the rather short period of amenorrheic postpartum nonsusceptibility they indicate for Thai women, suggesting that over half experience the return of menstruation within five months of giving birth. As expected from the longer duration of breastfeeding in rural areas, the return of menstruation is later for rural women than for urban women. However, even for rural women, the median duration of postpartum amenorrhea is only six months according to CPS1 and

slightly over five months according to CPS2, despite the fact that their median duration of breastfeeding is well over one year. Quite plausibly, the reason that breastfeeding in Thailand is not extending postpartum amenorrhea for longer periods may be the very short durations of full breastfeeding. There is considerable evidence available from a variety of studies indicating that the impact of breastfeeding on postponing the return of ovulation and thus extending amenorrhea is considerably less in the case of women who follow a mixed feeding regime (Van Ginneken, 1974).

The remarkably close agreement between the earlier estimate of a mean duration of six months based on the International Postpartum Program in the 1960s and the median durations based on the Contraceptive Prevalence Surveys should not obscure the fact that a decline in the average duration probably took place. Given that the earlier sample clearly underrepresented women who breastfed for longer durations, a more representative sample would surely have yielded a longer estimated duration of amenorrhea.

In brief, data on breastfeeding in Thailand suggest that a moderate decline in the average duration has taken place at the same time fertility has fallen. Nevertheless, breastfeeding is still close to universal, and substantially more than half of Thai women breastfeed for over a year. Supplemental food, however, is introduced at a very early age and probably reduces the potential inhibiting effect on fertility of the relatively long duration of breastfeeding. The median duration of postpartum amenorrhea is currently estimated at less than five months. Since the decline in the duration of breastfeeding has probably operated <u>against</u> the prevailing trend toward lower marital fertility, changes in other proximate variables must have more than counteracted it. As is demonstrated in the following chapters, the main reason marital fertility did not rise as a result of reduced breastfeeding was the massive increase in deliberate birth control, particularly the use of contraception.

NOTES

[1]According to a difference of means test (based on a simple random sample assumption), the difference between the two educational groups is statistically significant

at well beyond the .001 level for the general Bangkok subsample but not significant at even the .05 level for the other two subsamples.

[2]Two other studies of age at menarche in Thailand are cited by Bhumipadhi (1965). Both are apparently based on schoolgirls and thus could suffer from truncation bias. One study, published in 1932, reported a mean age at menarche of 13.7 and the other, dated 1962, reported a mean age of 13.9.

[3]A recent study based on the same data restricted analysis to those women who had husbands at home during the seven-day reference period, with a resulting monthly mean rate of coitus of 6.42 (Udry et al., 1982). This would translate into a weekly rate of 1.5, assuming 4.3 weeks to a month was used to convert the weekly frequencies into monthly ones. This is slightly higher than the mean of 1.3 indicated by Muangman et al. (1973). Presumably the difference is due to the exclusion in the more recent article of women whose husbands were not present. There is a minor discrepancy in total number of respondents indicated by the two articles, with the 1982 article stating 915 and the 1982 article stating 900. The 1982 article indicates that of the total 900 respondents, 95 or approximately 12 percent did not have their husband home at some time during the study period. The 1982 article apparently incorrectly reports that respondents were asked directly about coital frequency rather than being given cards to fill out privately (personal communication from J. Richard Udry).

[4]The effect cannot be large since less than 2 percent of women reporting a live birth in the two years prior to interviews reported that the birth did not survive. Given the prevailing levels of infant and child mortality in Thailand, the low percentage of women reporting a nonsurviving last birth suggests that there is some underreporting of those last births which died early in life. Presumably this affects all surveys equally.

[5]The average duration of breastfeeding per mother is usually longer than the average duration per child since women who breastfeed for short durations typically have more children than those who breastfeed for longer durations. Thus, in calculating an average per woman,

each woman is counted only once but when calculating an average per child, disproportionate weight is given to children of mothers who breastfed for short durations or not at all. For a full discussion of various methodological and conceptual problems in measuring prevalence and duration of breastfeeding, see Page et al. (forthcoming).

[6]For details on how the median duration of postpartum amenorrhea was calculated from these data, see Knodel et al. (1982).

CHAPTER 5

PROXIMATE DETERMINANTS 3: DELIBERATE MARITAL FERTILITY CONTROL

As indicated in Chapter 2, the recent fertility decline in Thailand has been largely a matter of reductions in marital fertility. Underlying this change has been a massive increase in the extent to which Thai couples deliberately limit their reproductive capacities by practicing birth control. In this chapter we examine this increase in deliberate marital fertility control in some detail, giving separate consideration to contraception and abortion. In addition, we consider briefly the extent to which infanticide and adoption are used as means of post-birth family limitation.

CONTRACEPTION

Systematic and representative information on the knowledge and practice of deliberate birth control within marriage is lacking for Thailand prior to 1969. Mention should be made, however, of the large-scale national Rural Economic Survey taken in 1930-31. While it undoubtedly does not conform to modern standards of sampling and survey technique, it nevertheless was the product of a self-conscious effort to collect a variety of representative social and economic data for rural Thailand based on field interviews in 40 villages in all regions. Apparently an effort was made to inquire about birth control. This study concludes ". . . the birth rate does not seem to be under human control. They [the respondents] do not know about birth control nor practice any form to any extent" (Zimmerman, 1931:230). Anthropologists frequently mention some form of abortion as being "traditional" although quantitative information is not provided (see, e.g., Riley, 1972:218; Mougne, 1978;

Lauro, 1979:11). Less frequent is any information on the extent to which traditional forms of birth control were known or practiced. Mougne (1978) mentions that lying by the fire for several weeks following a birth, a common practice in much of Thailand in the past, was thought of as a traditional form of birth control in the northern Thai village she studied. Riley (1972:324-325) indicates he found no evidence of planned abstinence or special practices for the purpose of birth control despite frequent inquiry into the subject during his field work in a central Thai village in 1970-71. He concludes that traditional birth control seems to have been limited to abortion. During field work in another central village during 1975-76, Lauro (1979) attempted to reconstruct detailed contraceptive histories of women in the village. Use of what he termed "modern contraception" was almost totally absent prior to the late 1960s, after which it increased substantially. Unfortunately, he does not seem to have inquired systematically into whether or not traditional forms of contraception were practiced. He notes, however (p. 107), that several of the older village women indicated that they had had large families themselves because, unlike present-day younger women, they had "lacked the means to control fertility" when they were in the prime childbearing years.

Postpartum abstinence of any extensive duration is apparently not commonly practiced in Thailand, judging from the lack of reference to it by most anthropologists. An exception is Mougne (1978), who reports that intercourse is generally said to be resumed soon after the end of the first postpartum month in the village she studied in northern Thailand.

KNOWLEDGE OF CONTRACEPTION

Evidence from national surveys, summarized in Table 33, clearly indicates that since 1969 there has been a marked increase in awareness of contraceptive techniques among both rural and urban women. At the time of the first round of the Longitudinal Study, about three out of four urban women were able to mention a method of contraception without being prompted, while slightly less than half of rural women could. Less than ten years later, almost all women, whether rural or urban, could mention at least one method. The most universally known contraceptive in Thailand is clearly the pill. It is also the most widely

TABLE 33 Contraceptive Knowledge Among Currently Married Women Aged 15-44: Thailand

Residence and Survey	Percent Knowing Method Without Prompting						Mean Number of Methods Known[a]
	IUD	Pill	Vasectomy	Ligation	Injection	Any[a]	
Rural							
LS1 1969	--	--	--	--	--	48	1.11
SOFT 1975	50	77	25	46	21	86	2.34
CPS1 1978/79	52	90	40	65	43	97	3.31
CPS2 1981	65	90	56	75	62	97	4.03
Urban							
LS1 1970	--	--	--	--	--	74	1.80
SOFT 1975	59	85	21	41	33	92	2.86
CPS1 1978/79[b]	59	87	28	59	45	98	3.49
CPS2 1981	68	94	49	72	65	98	4.35
National							
LS1 1969/70	--	--	--	--	--	53	1.23
SOFT 1975	51	78	24	45	22	87	2.41
CPS1 1978/79[c]	53	89	38	64	43	98	3.34
CPS2 1981	65	91	54	74	62	97	4.08

-- indicates information not available

[a]Including methods not listed.
[b]Bangkok metropolitan area.
[c]Excludes provincial urban.

Sources: Debavalya and Knodel (1979) and unpublished tabulations.

used method and the method most widely provided by the National Family Planning Program.

The average number of methods mentioned by respondents without prompting has also increased substantially over the last ten years, almost doubling for urban women and almost tripling for rural women. The pronounced urban-rural differential in contraceptive knowledge evident in 1969 narrowed considerably by 1975 and had virtually disappeared by the end of 1978. Thus almost all Thai women, both rural and urban, are now familiar with the idea of birth control and the large majority are aware of a reasonably wide range of specific modern methods.

The results of two regional studies conducted around the time of LS1 are also of interest. In 1969, a question on contraceptive knowledge was included in the Rural Employment Survey and asked of a sample of men in northern Thailand with wives in the reproductive ages. In 1970, a similar question was asked of men in southern Thailand. The results indicate that almost half of the rural northern Thai men and over three fourths of rural

southern Thai men indicated they had no knowledge of contraceptive methods (Jones and Rachapaetayakom, 1970; Jones and Soonthornthum, 1971).

Although there was some familiarity with contraception at the time of LS1, birth control methods were far less salient to women than they are now, especially in rural areas. While national-level data are not available prior to 1969, results of a 1964 survey of the Potharam district, a rural area about 80 kilometers from Bangkok, suggest that familiarity with contraception may have been considerably lower then and thus may also have been increasing rapidly during the 1960s. Of the more than 1,000 currently married women aged 20-44 interviewed in the Potharam district in 1964, approximately two thirds had ". . . no knowledge whatsoever of contraceptive methods" (Hawley and Prachuabmoh, 1971b:36).

With regard to traditional knowledge and practice of contraception, there is some information on awareness of nonmodern methods, particularly withdrawal, which in European populations was a major means of reducing fertility during the demographic transition. Unfortunately, such data are not available from the earliest survey, LS1. According to national tabulations from CPS1, conducted in 1978/79, only 23 percent of ever-married women, ages 15-49 indicated awareness of withdrawal as a birth control method, with 3 percent mentioning it spontaneously and another 20 percent indicating recognition when withdrawal was mentioned to them (Suvanajata and Kamnuansilpa, 1979:24). CPS2 results show a slightly higher awareness of the withdrawal method, with 29 percent indicating knowledge (Kamnuansilpa and Chamratrithirong, 1982). Results from NS in 1979, however, indicated considerably lower figures, especially for rural ever-married women: even with prompting, only 8 percent of them indicated any awareness of withdrawal as a contraceptive technique. The same study shows that only 16 percent of ever-married rural women aged 15-49 indicated awareness of abstinence as a method of limiting family size or spacing children (Institute of Population Studies, 1981). Presumably, this does not mean that Thai women are unaware of the connection between coitus and conception, but rather that they do not think of withdrawal and abstinence as ways of controlling their fertility and that these methods are not part of longstanding folk tradition.

CONTRACEPTIVE PRACTICE

Even more striking than the spread of contraceptive knowledge during the period under observation is the increase in contraceptive use illustrated in Table 34. For the country as a whole, the percentage of married women in the reproductive ages who reported currently practicing some method rose from less than 15 percent to

TABLE 34 Percent Currently Practicing Contraception Among Currently Married Women Aged 15-44, by Age and Place of Residence: Thailand

Residence and Year of Survey	Survey	Age of Women						All Ages	
		15-19	20-24	25-29	30-34	35-39	40-44	Unstandardized	Standardized for Age
Rural									
1969	LS1	0.4	4.2	10.9	16.2	14.0	10.0	10.9	10.5
1972	LS2	5.0	18.3	25.0	27.4	31.9	15.7	22.8	22.8
1975	SOFT	16.7	28.5	39.9	42.4	40.3	27.6	34.8	34.9
1978-79	CPS1	30.0	44.6	53.5	58.4	59.4	45.8	51.3	51.2
1979	NS	20.0	32.4	51.5	61.3	57.0	40.4	47.5	47.2
1979	AFPH[a]	20.8	33.5	49.1	59.6	56.4	45.4	47.1	47.2
1981	CPS2	27.1	46.1	60.8	67.0	66.9	53.7	57.7	57.0
Urban									
1970	LS1	(12.0)	18.9	29.7	43.6	37.2	30.2	32.6	30.9
1973	LS2	(15.6)	29.6	45.6	51.0	53.3	46.3	45.1	43.2
1975	SOFT	(32.6)	46.8	47.2	54.3	54.8	48.9	49.4	49.2
1978-79	CPS1[b]	(38.1)	42.7	58.5	73.3	77.8	69.8	62.8	62.5
1979	NS	--	(35.9)	58.3	60.0	69.8	60.6	57.6	53.9
1979	AFPH[a]	(27.3)	45.8	53.1	74.1	72.6	62.6	59.3	59.3
1981	CPS2	(41.7)	55.0	58.9	71.0	76.2	70.3	65.2	64.3
National									
1969-70	LS1	3.8	6.9	14.4	22.0	18.0	13.1	14.8	14.4
1972-73	LS2	6.0	20.1	28.6	31.4	35.6	19.4	26.3	26.0
1975	SOFT	18.1	30.9	41.0	44.0	42.3	30.5	36.7	36.8
1978-79	CPS1[c]	31.3	44.2	54.4	61.1	62.8	49.5	53.4	53.1
1979	NS	19.5	32.9	52.7	61.1	59.5	44.2	49.3	48.5
1979	AFPH[a]	21.4	34.5	49.6	60.9	57.5	47.1	48.1	48.2
1981	CPS2	29.0	47.5	60.4	67.7	68.6	56.4	59.0	58.2

Notes: The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis of the age standardization. Results based on at least 10 but fewer than 50 cases are shown in parentheses; results based on fewer than 10 cases are not shown.

[a]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.
[b]Bangkok metropolitan area.
[c]Excluding provincial urban.

Sources: Debavalya and Knodel (1978); Debavalya (1981); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

close to 60 percent in the 12 years covered by the surveys.[1] While there is some difference in the prevalence rates indicated by the three surveys taken within less than a year of each other, between the end of 1978 and 1979, they all show markedly higher prevalence rates than previous surveys and lower rates than the 1981 survey. Presumably there has been a steady rise in contraceptive prevalence over the period covered and the differences among the 1979 surveys reflect sampling fluctuation and differences in the answers to which they refer. Moreover, the increase is greater among rural women, of whom only 10 percent were practicing contraception in 1969. As a result, rural-urban differences in contraceptive prevalence have narrowed substantially. Even the low prevalence rate for rural women in 1969 (10 percent) may be the result of a recent prior increase, given that the 1964 survey in the Potharam district found only 4 percent of married women aged 20-44 were currently practicing contraception and only 5 percent had ever practiced contraception (calculated from Hawley and Prachuabmoh, 1971a). Likewise Lauro (1979), in his study of a central Thai village, found prevalence increasing from the mid-1960s.

The increase in contraceptive prevalence has clearly occurred at all age groups. On the national level, in almost all the surveys, the highest rate is found among women in the 30-34 group, although rates in the 35-39 group are usually very close. For women in their early forties, however, the percentage currently practicing contraception is noticeably lower, undoubtedly reflecting in large part a recognition of reduced risk of pregnancy as they approach the end of their childbearing years. The lowest rates are consistently indicated for the youngest age group of married women, who presumably have the least incentive to limit their fertility since they are just beginning their childbearing and typically average less than one child ever born (Debavalya, 1981).

While women can discontinue contraceptive use as they become older and perceive that they are no longer risking pregnancy, the percentage of a cohort that has ever used contraception should increase with age up to the point when the last woman in the cohort who eventually adopts contraception does so. To gain an impression of the increase of contraceptive usage with age for a particular cohort, one can examine the proportions ever practicing contraception for successive age groups in the three surveys included in Table 35.

TABLE 35 Percent Who Ever Used Contraception Among Currently Married Women Aged 15-49, by Age and Residence: Thailand

Age Group	Rural			Urban			National		
	LS1 1969	SOFT 1975	NS 1979	LS1 1970	SOFT 1975	NS 1979	LS1 1969/70	SOFT 1975	NS 1969
15-19	3.8	25.9	30.0	(14.0)	(51.1)	--	5.0	28.3	28.6
20-24	5.6	40.8	42.7	26.4	64.3	(48.7)	9.4	43.9	43.7
25-29	14.3	56.1	62.1	39.6	66.9	70.0	19.1	57.7	63.6
30-34	21.2	57.4	73.8	50.9	71.5	78.3	27.4	59.2	74.7
35-39	16.3	55.7	65.4	44.7	68.5	84.1	21.2	57.4	69.0
40-44	15.0	51.1	55.7	33.3	60.4	74.2	17.8	43.7	59.2
45-49	[a]	24.8	31.5	24.2	44.8	(69.8)	--	27.6	37.4
Age standardized									
15-44	13.9	49.1	58.4	37.7	64.9	67.0	18.3	51.3	60.1

Notes: The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis of the age standardization. Results based on at least 10 but fewer than 50 cases are shown in parentheses; results based on fewer than 10 cases are not shown.

[a]In the rural phase of LS1, only women under age 45 were asked about contraceptive use.

Several caveats are appropriate with regard to the data in Table 35. Since the table refers only to currently married women, the data at younger ages refer only to those women in a cohort who marry early and who may be unrepresentative of the cohort as a whole as it ages and additional women in the cohort marry. Presumably few of the women who had not yet married were practicing contraception (see, e.g., Yoddumnern, 1981), but we have no way of knowing what proportions would have had they already been married. (The problem in interpretation is similar to the one discussed in Chapter 2 in connection with the total expected number of children in Table 13). In addition, the times between the surveys are not exact multiples of five years in every case, further detracting from the precise identity of particular cohorts over time when age is tabulated in five-year age groups as is the case in Table 35. However, since the time period between the surveys never deviates by more than one year from a five-year interval, we can at least approximate the experience of a particular cohort over time by comparing successive age groups across the three points in time.

The comparison clearly indicates that the proportion who had ever practiced contraception within individual cohorts increased sharply as the cohort became older. For example, the proportion of the cohort of rural women aged 20-24 in 1969 that ever practiced contraception increases from 6 percent in 1969, to 56 percent in 1975, and to 74 percent by the time they are aged 30-34 in 1979. Sharp increases are indicated for most cohorts, although several inconsistencies are apparent. The most glaring appears among rural women who were aged 40-44 in 1975: the proportion reporting ever using contraception was 41 percent in 1975, whereas four years later the 45-49-year age group reported only 32 percent ever used. Such inconsistencies are rare, however, and may arise from either reporting or sampling error. The generally sharp increase in ever use with age for cohorts is in contrast to the impression gained by comparing successive age groups in the cross-sections provided by any one of the particular surveys. In this period of rapid change, the cross sections are clearly inadequate for estimating cohort experience.

The specific methods of contraception being used by respondents are indicated in Table 36 and Figure 5 (after standardization for age). With the exception of LS1, which shows female sterilization as the most popular technique, all subsequent surveys at the national level

TABLE 36 Percent Currently Practicing Specific Methods of Contraception, Among Currently Married Women Aged 15-44, Standardized for Age, Classified by Residence: Thailand

Residence and Year of Survey	Survey	Pill	IUD	Sterilization		Injection	Condom	Others	All Methods
				Male	Female				
Rural									
1969	LS1	2.7	2.1	1.9	2.9	0.4	0.0	0.5	10.5
1972	LS2	9.7	4.6	2.7	4.5	0.8	0.0	0.2	22.8
1975	SOFT	14.3	6.8	2.2	6.6	2.1	0.3	2.7	34.9
1978/79	CPS1	23.1	3.7	3.5	10.4	4.9	1.5	4.1	51.2
1979	NS	21.4	1.9	4.2	12.4	6.1	10.6	0.7	47.2
1979	AFPH[a]	17.9	4.9	5.4	11.0	5.8	1.0	1.0	47.2
1981	CPS2	20.4	4.4	4.2	17.0	7.6	1.2	2.3	57.0
Urban									
1970	LS1	8.9	2.2	2.9	14.9	0.5	0.3	1.4	30.9
1973	LS2	16.6	5.0	3.5	16.5	1.2	0.6	1.9	43.2
1975	SOFT	20.3	5.0	2.3	13.6	2.1	1.6	4.3	49.2
1978/79	CPS1[b]	16.4	5.5	3.3	24.6	3.5	5.3	4.0	62.5
1979	NS	16.7	4.2	2.3	24.8	2.7	1.0	2.3	53.9
1979	AFPH[a]	15.6	3.2	2.6	28.2	4.7	3.0	1.9	59.3
1979	NS	16.7	4.2	2.3	24.8	2.7	1.0	2.3	53.9
1981	CPS2	19.5	2.6	3.8	24.9	4.1	5.1	4.3	64.3
National									
1969/70	LS1	3.8	2.1	2.0	5.1	0.4	0.1	0.7	14.4
1972/73	LS2	10.8	4.7	2.8	6.4	0.9	0.1	0.5	26.0
1975	SOFT	15.1	6.6	2.2	7.5	2.0	0.5	2.9	36.8
1978/79	CPS1[c]	22.0	4.0	3.4	12.9	4.6	2.2	4.0	53.1
1979	NS	20.6	2.1	3.9	14.8	5.4	0.7	1.0	48.5
1979	AFPH[a]	17.7	4.8	5.2	12.5	5.7	1.2	1.0	48.2
1981	CPS2	20.1	4.1	4.1	18.4	6.9	1.9	2.7	58.2

Notes: The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis of the age standardization. Rounding errors, minor coding discrepancies, and users of unspecified methods account for the small differences between the sum of the percentages practicing individual methods and the percentage for all methods.

[a]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.
[b]Bangkok metropolitan area.
[c]Excluding provincial urban.

find the contraceptive pill the most commonly used method. Recent sharp increases in female sterilization, however, make it a close second by 1981. A distinct rural-urban difference also exists. All four of the most recent surveys find that in urban areas the pill is second to female sterilization, as it was at the time of LS1 as well. Indeed, in 1981 approximately one out of every four urban, currently married women in the reproductive ages reported having been sterilized. The higher rates of sterilization in urban areas undoubtedly reflect the greater accessibility there to medical facilities

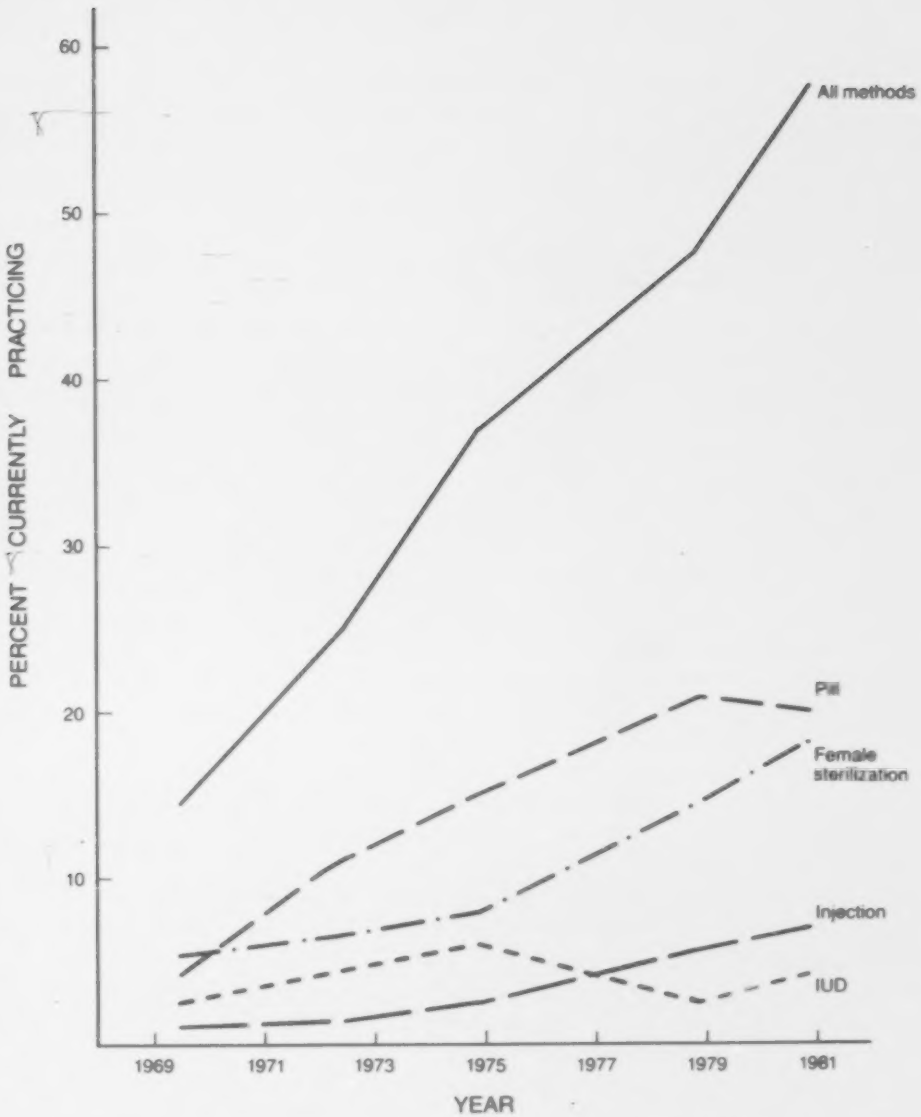


FIGURE 5 Percent Currently Practicing Specified Methods of Contraception from Surveys, 1969-70 to 1981: Thailand

Sources: 1969-70 LS1; 1972-73 LS2; 1975 SOFT; 1979 NS; 1981 CPS2.

providing sterilization services. Even among rural women, however, the proportion sterilized is substantial and is approaching one out of every five currently married women, according to the most recent surveys.

THE CONTRIBUTION OF THE NATIONAL FAMILY PLANNING PROGRAM

The coincident timing of the development of an active national family planning program and the increase in contraceptive use suggests there is a connection between the two. Although the program was officially established in 1970, training activities began in early 1968 and by the time the national policy was declared in 1970, personnel had been trained in almost all provinces and the program was operating to some extent in most rural areas by or shortly after that time. Moreover, family planning was available through government hospitals in urban areas even earlier (Rosenfield et al., 1982). Since substantial proportions of urban women reported themselves as already using contraception in 1970 before the official program was launched, many were undoubtedly availing themselves of both the family planning services provided by these hospitals and commercially available contraception. Surveys indicate that the situation was quite different in rural areas. Only very minimal usage of contraception appears to pre-date the onset of the national program.

The particular mix of methods as well as the trends in different methods are undoubtedly associated with developments in the National Family Planning Program. For example, the popularity of the pill in rural areas is no doubt related to its wide availability, especially through outlets of the Ministry of Public Health, and coincides with the fact that during the last decade the majority of new acceptors reported by the National Family Planning Program chose the pill. In addition, the high rates of female sterilization are probably related to the increasing emphasis this method is being given in the national program, especially in the last few years (Joint Thai/U.S. Evaluation Team, 1979; Rosenfield et al., 1982).

The number of family planning acceptors officially attributed to the program (which includes most acceptors to affiliated private programs) has grown almost steadily since its inception, increasing from an average of about 60,000 new acceptors per year during 1965-68 to over 1 million by 1979. As Table 37 indicates, the largest

TABLE 37 New Acceptors in the National Family Planning Program: Thailand

Year	Total[a]	Pill	IUD	Injectable Hormonal	Female Sterilizations	Vasectomy
1965-68	186,893	17,861	125,458	--	47,574	
1969	130,219	60,459	54,496	--	15,264	
1970	225,439	132,387	74,404	--	18,648	
1971	404,187	294,607	86,304	--	23,546	
1972	456,694	327,582	90,128	6,316[b]	32,668	
1973	422,176	268,674	93,449	10,447[b]	49,606	
1974	494,479	305,244	89,739	19,014[b]	73,702	6,780
1975	535,023	345,117	75,163	24,559[b]	82,650	7,534
1976	627,239	376,707	71,894	73,357	95,131	10,150
1977	758,212	488,765	74,794	68,714	106,816	19,123
1978	890,713	557,857	77,775	86,620	124,205	44,256
1979	984,590	614,525	78,082	117,451	138,732	35,300
1980	1,065,518	653,610	79,378	149,744	151,681	31,105

-- indicates information not available.

[a]Includes only methods listed here, except for the years 1972-75.
[b]Totals include acceptors of methods not listed here such as condoms and foam.

Source: Mimeographed material from Thailand, Ministry of Public Health, and personal communications.

share of acceptors is attributed to the pill, which accounts for more than half of all acceptors for each year shown.

The program's success in reaching a large number of acceptors is undoubtedly due to a variety of factors. Of particular importance from the point of view of the program's structure has been the involvement of health personnel at all levels in family planning activities and especially the delegation of family planning tasks to paramedical personnel. In 1970, a decision was made to allow auxiliary midwives and nurses to provide the contraceptive pill, thus expanding enormously the number of personnel and service outlets for pill distribution. Another factor that apparently boosted pill use and ultimately the number of contraceptive users was the decision in 1976 to provide the pill free of charge. After that, a marked and sustained increase in the number of pill acceptors occurred without a compensating decline in acceptors of other methods or in commercial sales (Joint Thai/U.S. Evaluation Team, 1979). The use of midwives and nurses along with the free-pill policy undoubtedly contributed to the widespread use of the pill in Thailand.

Sample surveys such as CPS1, AFPH, and CPS2 are especially useful in assessing the extent of the government's contraceptive services independent of the government's official program statistics. Table 38 indicates the source of contraception reported by ever-married women in the reproductive ages who were currently using contraception at the time of each survey. As all three surveys clearly show, the large majority of users indicate a government source as the provider of their method of contraception. In both CPS1 and CPS2, more than three out of four women indicated they obtained their method from a government outlet. Nevertheless, the private sector, particularly drug stores, are a fairly significant source of contraception, accounting for between one fourth and one fifth of users nationally. As might be expected, given the more extensive commercial network and concentration of private clinics in urban areas, the importance of the private sector is greater for urban than for rural women. Among rural women, about four out of five rely on the government for provision of family planning services while only two thirds of urban women do.

A recent study attempted to assess the impact of the national program on fertility by estimating the number of births averted through use of program-supplied contraception (Khoo, 1979). A range of estimates is provided that depends on the particular combination of fertility schedules and continuation rates input into the computer model used for the calculations. The results suggest that a reasonable estimate of the national program's effect on births averted would account for close to 80 percent of the decline in the total fertility rate between 1964 and 1975, assuming no substitution of program methods for nonprogram methods. Allowance for substitution would, of course, reduce the estimated impact of the program. Unfortunately, it is not possible to estimate with any certainty how much substitution occurred. At the same time, however, the computer model used for the estimation ignores the possibility that new acceptors may be self-selected for higher-than-average fertility and that some nonprogram birth control might be stimulated by the program.

FAMILY LIMITATION AND BIRTH SPACING

There is evidence accumulating from both historical studies of Europe and contemporary experience in the

TABLE 38 Percent Ever-Married Women Aged 15-49 Currently Using Contraception, by Source and Residence: Thailand

Source of Contraception	AFPH 1969			CPS2 1981		
	Rural	Provincial Urban	CPS1 1978-79	National	Rural	Urban
Government	78.9	62.9	76.9	78.4	81.2	66.7
Private	21.1	37.1	23.1	21.6	18.8	33.3
Drugstore	10.6	19.0	11.3	12.0	10.0	20.4
Clinic/Hospital	8.6	16.6	6.3	7.6	7.0	9.9
Other	1.8	1.5	5.5	2.0	1.8	3.0
Total	100	100	100	100	100	100
N	1,418	542	(1,349)	(3,633)	(2,927)	(706)

Notes: Results refer to all current users, including a small number not currently married. CPS1 excludes the provincial urban population.

Sources: Kamnuansilpa et al. (1982), and unpublished tabulations.

developing world that the introduction and spread of birth control for limiting family size rather than increasing child spacing is a key feature in the initial stages of the fertility transition (Knodel, 1979, 1981; Siddiqui, 1979; for a dissenting view, see Friedlander et al., 1980). Thus we would expect couples who already have all the children they want to be the most receptive to adopting birth control as it spreads through the population. In his study of a central Thai village, Lauro (1979:243) reports: "Villagers were unanimous in expressing that their objective in practicing family planning was to curtail fertility rather than to space children or defer childbearing to a later time." He indicates that his finding was confirmed through in-depth qualitative investigation.

As the results in Table 39 clearly show, the percentage practicing birth control is substantially higher among couples who indicate that they want no more children than among those who still wish to have additional children. As would be expected, the increase in contraceptive prevalence has been more pronounced among the former group, with almost seven out of ten practicing contraception in 1981 among couples in which the wife is under age 45 and indicates she wishes to stop having children. Indeed, among the urban population more than three fourths of couples in this situation indicate they are currently practicing some form of contraception. Nevertheless, the practice of contraception for spacing births is also becoming more common, as indicated by the increase in contraceptive prevalence among couples in which the wife indicates she wants additional children. The most recent survey, CPS2, indicates that four out of ten couples who still want additional children are practicing birth control for spacing purposes.

A direct question on whether contraception was being practiced to space children or to terminate childbearing was asked current users in the Northeast Survey (NES) taken in 1980. The results indicate that 70 percent said their use was to stop childbearing altogether, 26 percent said they were spacing, and the remainder indicated they were unsure.

An initial dominance by the motivation to limit family size and the subsequent increasing importance of the spacing motivation over the course of the fertility decline is also evident in data collected from new acceptors to the National Family Planning Program. As indicated in Table 40, when the expanded National Program

TABLE 39 Percent Currently Practicing Contraception Among Currently Married Women Aged 15-44, by Residence and Desire for Additional Children: Thailand

Residence and Year of Survey	Survey	Desire for Additional Children: Want More	Want No More	Not Sure
Rural				
1969	LS1	1.2	16.7	--
1972	LS2	9.7	30.7	(16.7)
1975	SOFT	22.4	41.0	34.8
1978-79	CPS1	37.5	58.3	(46.5)
1979	NS	24.8	62.6	--
1979	AFPH[a]	26.8	59.1	--
1981	CPS2	40.3	67.5	50.6
Urban				
1970	LS1	17.1	46.4	16.0
1973	LS2	19.7	62.6	45.6
1975	SOFT	35.7	59.1	(29.1)
1978-79	CPS1[b]	43.0	74.5	--
1979	NS	26.6	76.9	--
1979	AFPH[a]	36.5	73.4	--
1981	CPS2	45.3	77.1	(23.5)
National				
1969-70	LS1	4.5	21.3	(8.7)
1972-73	LS2	11.4	35.0	(30.7)
1975	SOFT	24.6	43.1	33.0
1978-79	CPS1[c]	38.6	61.1	46.0
1979	NS	25.1	65.2	--
1979	AFPH[a]	29.2	62.7	--
1981	CPS2	41.2	69.2	46.0

Notes: Results based on at least 10 but fewer than 50 cases after weighting are shown in parentheses; results based on fewer than 10 cases are not shown.

[a]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.
[b]Bangkok metropolitan area.
[c]Excluding provincial urban.

TABLE 40 Percentage Distribution of New Acceptors in the National Family Planning Program by Desire for Additional Children: Thailand

Year of Survey	Want More	Want no More	Unsure
1971-72	13.6	67.6	18.8
1973	19.5	61.6	19.0
1974	21.3	59.8	18.9
1975	22.6	57.9	19.5
1976	23.1	56.0	20.9
1977	25.9	55.4	18.7
1978	28.5	52.6	18.9
1979	28.4	53.5	18.2
1980	29.7	51.7	18.6

Source: Unpublished material from Thailand, Ministry of Public Health, and personal communications.

began in the early 1970s, more than two thirds of new acceptors indicated they wanted no more children. However, this share of acceptors has declined almost without exception in each subsequent year, so that by 1980 only slightly more than half of new acceptors indicate that they are ready to terminate childbearing altogether. At the same time, the share of new acceptors who indicate that they still want additional children has increased almost without interruption, so that close to 30 percent of new acceptors by 1980 are apparently adopting family planning from the National Program explicitly for spacing purposes. The proportion of acceptors who were unsure about their future fertility plans has remained remarkably steady throughout the decade at slightly less than one fifth of all acceptors.

Thailand seems to be rapidly approaching a situation where deliberate fertility control within marriage will be exercized widely for both spacing and stopping births. Even during the very short time that the fertility transition has been underway in Thailand, one can see the same evolution in contraceptive practice patterns with respect to spacing and stopping that probably occurred over a much longer period in the past for developed countries. This suggests that the demand for family planning services for spacing purposes will

probably contribute significantly to the overall demand in the future.

ABORTION

While the various surveys clearly document both the general increase in contraceptive practice and the methods of contraception used, they are less helpful for determining the amount of induced abortion in Thailand. Because abortion is illegal under most circumstances and, unlike contraception, is believed by many to be contrary to the principles of Buddhism, responses to direct survey questions on the use of abortion are generally assumed to seriously understate its prevalence.

In response to a direct question, only 3 percent of ever-married women under age 50 acknowledged ever having resorted to abortion as a means of birth control in CPS1 and only 2 percent did so in CPS2 (Kamnuansilpa and Chamratrithirong, 1982). In the FPHH study, which interviewed approximately 8,000 married women in the reproductive ages in the northeast region, only 1.5 percent admitted to ever having had an induced abortion (Porapakkham and Bennett, 1978:89). In the northern Thai fertility study, interviews with almost 2,000 women in two northern Thai provinces revealed reported rates of 2.4 percent in Chiang Mai province and 0.7 percent in Chiang Rai province (Shevasunt and Hogan, 1979:35). It is virtually certain that responses to direct questions in the surveys grossly underestimate the prevalence of induced abortion. It is interesting that Riley (1972:218) indicates that despite the fact that there was an abortionist in the village he studied and that he knew of specific instances of induced abortion, only one woman admitted to having had an induced abortion in the course of the systematic interviews he conducted to collect fertility histories.

Results from a number of sources other than direct survey questions suggest that the prevalence of induced abortion may be substantial in Thailand. A 1978 study of abortion practitioners in rural Thailand (Research and Evaluation Unit, National Family Planning Program, 1979) indicates that abortion is widely practiced, using methods ranging from very primitive to modern. Of these methods, massage abortion appears to be the most common. The study estimated that there are a minimum of around 300,000 illegal abortions per year in rural and provincial urban

Thailand. This would correspond to approximately one abortion for every four live births or an abortion rate of approximately 37 per 1,000 women, excluding the Bangkok population, which was not covered in this particular study. A 1980 study in an overwhelmingly rural northeastern province, again based on interviews with indigenous practitioners, indicated a considerably higher incidence of abortion: over eight abortions for every ten live births and an abortion rate of 107 per 1,000 women aged 14-44 (Narkavonnakit and Bennett, 1981).

An earlier attempt to estimate the national annual abortion rate, based on country-wide hospital admissions for incomplete abortions, indicated a total of 200,000 to 230,000 cases of induced abortion per year during 1972-73, corresponding roughly to an induced abortion rate of 28 per 1,000 women aged 15-45 (Cook and Leoprapai, 1974, cited in Baker and Clinton, 1981). The estimate is based on a series of assumptions that can be called into question. For example, they assume that all reported hospital admissions for incomplete abortions represent incomplete induced abortions. This is almost certainly not true and would bias their estimate upward. On the other hand, they assumed that hospital admissions represent approximately 10 percent of all induced abortions which may be too high and thus bias their estimate downward. For example, Narkavonnakit and Bennett estimate that in the northeastern province they studied only about 2.4 percent of induced abortions resulted in hospital admissions. Although firm estimates of the extent of induced abortion are not available for Thailand, and existing estimates can be called into question on the basis of representativeness and accuracy, it seems fairly clear that induced abortion is substantial in Thailand and should not be ignored as a factor influencing recent levels of fertility. In this connection, it is worth noting that a variety of studies make it clear that substantial numbers of abortions, perhaps the large majority, are attributable to married women, especially in rural areas and thus have potentially important influence on the level of marital fertility (see Baker and Clinton, 1981).

Limited evidence suggests that the overall prevalence of abortion has increased substantially during the same period that contraceptive practice has risen sharply. An extensive study based on a large number of hospitals throughout the country indicates a three-fold increase between 1966 and 1974 in the number of cases admitted for

complications associated with abortion. Although information specifying whether the complications resulted from induced or spontaneous abortion was not available, the author reports that many cases were probably the result of illegally induced abortions (Rauyajin, 1979). Another study based on admissions for induced abortion to a Bangkok hospital, indicates a steady 3.6-fold increase between the first three years, 1968-70, and 1977, followed by a slight decline during the next two years (Koetsawang, 1980; Baker and Clinton, 1981). These studies clearly suggest a major trend toward increased abortion at the same time contraceptive use is rapidly increasing.

At this stage in Thailand's fertility transition, it appears that both abortion and contraceptive use are part of the same process whereby family limitation is spreading rapidly throughout the population. As the fertility transition advances and contraceptive use becomes virtually universal and more efficient, and especially if the prevalence of sterilization continues to increase, the number of abortions in Thailand should decline. Perhaps the results from the Bangkok hospital study showing a decline since 1977 are beginning to signal such a change. A pattern of initial increase in abortions followed by a decrease may be a relatively common feature of fertility transitions in a number of countries (see Population Crisis Committee, 1979).

INFANTICIDE AND ADOPTION

In the absence of or in addition to birth control within marriage, mechanisms that can effectively reduce family size include infanticide, child abandonment, and transferring children out to live with others who are willing to care for them. While such factors cannot be thought of as proximate <u>fertility</u> variables, they can have the effect of limiting family size. We are unaware of any studies directed at examining the existence of deliberate infanticide, underinvestment in childcare (sometimes called infanticide by neglect), or child abandonment for Thailand with reference to either the past or present, although de Young (1955:49) states that "infanticide is so unthinkable by Thai Buddhist standards that anyone who committed it would be judged insane." Lauro (1979:106) notes that almost all villagers in the central Thai village he studied claimed to spend substantial sums of

money on medicines and treatment to keep their children well. However, Mougne (1978:83) does not rule out the possible infrequent practice of infanticide in the northern Thai village she studied and cites "pinching of the nose of the newborn" or deliberate neglect as the means. She concludes ". . . information regarding this is extremely difficult to obtain in Buddhist society, and it is unlikely to have ever been a major factor in traditional fertility limitation."

In contrast to the nearly unanimous views discounting infanticide, several observers have commented on transferring children through adoption as a way of coping with unwanted fertility under special or extreme circumstances. In his study of a central Thai village, Riley (1972: 228-229) indicates that 6 percent of first births tabulated in his study of pregnancy histories and pregnancy outcomes were reported as having been given to someone else to raise. Most cases involved young mothers whose babies were reared by other kin. Henderson (1971:68) states that ". . . families with large numbers of children may send one or more children to stay with relatives, neighbors, or in the case of boys, to the wat (Buddhist temple), where . . . they act as servants to the monks." They also state that "children are frequently adopted, especially by childless couples" (p. 71). Their description makes it clear that people are not referring to orphans but to children whose parents are still alive. In an article describing his own experience, being sent to live as a monk's apprentice at an early age, Sudham (1980:67) states that ". . . to give one of your children to be adopted by strangers for a sum of money or for free had been a common practice of peasants who have a large brood of youngsters, particularly in years of drought."

Data from the AMS provide a unique opportunity to evaluate the extent to which children lived separately from their biological parents and thus provide some idea of the extent of child transfer through adoption. In the course of collecting the life histories of respondents in the AMS, information was recorded indicating with whom the respondent lived at the time she was approximately ten years old. The data thus referred to the situation approximately a generation ago. Since information was also collected on when the parents died if they were no longer alive, it is possible to examine the percentage of respondents who were not living with either biological parent at age ten according to the survival status of the parents. As is evident from the results presented in

TABLE 41 Percent of Ever-Married Women Reporting Not Living with Either Biological Parent at Age 10, by Survival Status of Parents at Age 10: Thailand

Area	Survival Status of Parents at Age 10		
	Both Parents Alive	Mother Alive Father Dead	Father Alive Mother Dead
Bangkok General	4.3 (415)	5.3 (57)	28.6 (28)
Bangkok Slums	6.1 (425)	11.1 (45)	44.4 (27)
Semi-Rural	2.6 (568)	4.2 (48)	38.2 (34)

Source: Asian Marriage Survey.

Table 41, the respondents were more likely to report living with someone other than the biological parents if one of the parents had died, particularly the mother. Of greater interest are the results referring to the situation where both parents were still alive. In all three subsamples, a small percentage of respondents indicated that they did not live with parents even though both parents presumably were alive. The results suggest that this phenomenon was most prevalent among the Bangkok slum respondents, perhaps reflecting their poorer economic background during their childhood. These estimates are probably somewhat understated since we attempted to be conservative when judging from the data available whether a respondent's parents were alive at the time of her reaching age ten. Clearly, more direct evidence on this phenomenon would be required before any firm conclusions could be reached about its extent. It would be particularly interesting to examine whether the phenomenon of child transfer through adoption had been affected by the advent of widespread birth control.

NOTE

[1]Contraceptive prevalence as discussed in the present study includes use of all methods of contraception including "male" methods such as condoms or vasectomy. For the sake of convenience, however, prevalence is expressed as the percentage of women who are currently using or who have ever used some method, since the information on contraceptive use is typically elicited from women respondents.

CHAPTER 6

ESTIMATING THE IMPACT OF THE PROXIMATE DETERMINANTS ON FERTILITY

The observed fertility level of a population can be affected by variations in any of the intermediate variables as proposed by Davis and Blake (1956) or as reorganized and proposed as proximate determinants by Bongaarts (1978). However, Bongaarts (1980b) has demonstrated that only four proximate determinants--namely, the proportion married, contraception, induced abortion, and postpartum infecundability--are of any substantial importance in the analysis of fertility differences or trends, because variations in the population averages of the other factors usually are not large enough to make a substantial impact on fertility. He has proposed an analytical accounting scheme which enables us to assess the impact of each of these four principal proximate variables on the fertility level at any given point in time and to examine changes in their impact over time (Bongaarts, 1978). The fertility-inhibiting effect of each is assessed by comparing an estimate of the fertility level that would prevail in its presence and then in its absence. The potential fertility level that would prevail in the absence of the four principal proximate variables (i.e., under conditions in which all women in the reproductive ages were married and there was no breastfeeding, induced abortion, or contraception) is called the total fecundity rate. The level of total fecundity varies from population to population due to differences in the other proximate variables. Based on empirical analysis of a number of populations, Bongaarts has found that the total fecundity rate averages about 15.3 births per woman.

In the Bongaarts model, the impacts of the four principal intermediate fertility variables are measured by four indexes, each ranging from 0 to 1. When a given

intermediate variable has no fertility-inhibiting effect, the corresponding index equals one; if the fertility inhibition is complete, the index equals zero. The four indexes are defined as follows:

C_m = index of proportion married (equals 1 in the absence of celebacy and 0 in the absence of marriage);

C_c = index of contraception (equals 1 in the absence of contraception and 0 if all fecund women use 100 percent effective contraception);

C_a = index of induced abortion (equals 1 in the absence of induced abortion and 0 if all pregnancies are aborted); and

C_i = index of postpartum infecundability (equals 1 in the absence of lactation and postpartum abstinence and 0 if the duration of infecundability is infinite).

Since each index equals the proportionate reduction in fertility that it causes, the total fertility rate (TFR) is a product of the four indexes times the total fecundity rate (TF): $TFR = TF \times C_m \times C_a \times C_c \times C_i$.

The Bongaarts indexes can be estimated from a series of reproductive measures. In Table 42, measures and indexes required for the Bongaarts model are presented for four points in time corresponding to the one-year periods on which estimates of total fertility derived from LS1, LS2, SOFT, and NS were based. These four surveys were chosen because they were all conducted by or in collaboration with the same organization, the Institute of Population Studies at Chulalongkorn University, and thus should be relatively comparable. Details on the calculations of the reproductive measures are provided in the notes to the table. Each is based in some way on the data reviewed in the previous chapters.

It is worth stressing that several of these measures--in particular those referring to contraceptive effectiveness, induced abortion, and to a lesser extent lactational infecundability--require that a variety of assumptions be made in order to convert the observed data into measures. The utility of the Bongaarts model, however, does not depend on the availability of absolutely precise estimates of the required measures. As long as reasonable though rough estimates are possible, the model can be quite useful in providing the orders of magnitude for the extent to which the four principal proximate determinants inhibit

TABLE 42 Estimates of Selected Reproductive Measures and Derived Indexes of Four Proximate Determinants According to Bongaarts's Model: Thailand

	Year to Which Estimates Refer			
	1968	1971	1974	1978
Measure				
Total fertility rate (TRF)	6.12	5.30	4.52	3.38
Total marital fertility rate (TFMR)	9.23	8.07	7.03	5.49
Current contraceptive use (u)	.14	.26	.37	.49
Contraceptive effectiveness (e)	.95	.94	.92	.93
Total induced abortion rate (TA)	.41	.55	.69	.83
Lactational infecundability (i)	8.7	8.6	8.1	6.6
Model Indexes				
Index of proportions married				
C_m = TMFR/TFR	.66	.66	.64	.62
Index of contraception				
C_c = (1 - 1.08 ue)	.85	.74	.64	.51
Index of induced abortion				
C_a = TFR/(TFR + (.4 x (1+u) x TA))	.97	.95	.92	.88
Index of lactational infecundability				
C_i = 20/(18.5 + i)	.74	.74	.75	.82
Combined indexes				
$C_m \times C_c \times C_a \times C_i$	.40	.34	.28	.24

Notes: Where applicable, data for 1968, 1971, 1974, and 1978 are based on LS1, LS2, SOFT, and NS, respectively. TMF is calculated from Table 9 with estimated rates for the 15-19 age group, calculated as .75 times the rate of the 20-24 age group, substituted for the observed rates; u is based on age-standardized rates reported in Table 34. The estimates of e are derived from the distribution of methods presented in Table 36, applying an effectiveness rate of 1 for sterilization, .95 for IUD, .90 for pill and injection, and .70 for all others. These effectiveness rates were suggested by John Bongaarts (personal communication) and are adapted to data from the Philippines. TA for 1978 was based on a rate of 27.75 abortions to married women per 1,000 total women aged 15-44 derived by assuming that the national abortion rate for married women is three fourths the 37 per 1,000 women rate reported by Research and Evaluation Unit, National Family Planning Program (1979). The rate for 1968 was assessed to be half of this and to increase linearly to 27.75 by 1977. The mean number of months of lactational infecundability, estimated as 6.6 for 1978, was derived from the median value of 4.9 from CPS1 and the relationship between mean and median values of postpartum amenorrhea indicated in Lesthaeghe (1982:Figure II). Values for earlier years are proportional to the duration of breastfeeding based on the earlier surveys relative to the duration based on NS.

fertility, how their contributions change over time, and the contribution each makes to changes in fertility.

According to our calculations, marital structure alone reduces the total fecundity rate by a third or more during the decade under observation. The intercensal trends toward increasing proportions single and corresponding decreasing proportions of women currently married are reflected in the declining C_m index. Thus the proportions married were inhibiting potential fertility somewhat more by the end of the decade under observation than at the start. As would be expected, the index of contraception declined very substantially, reflecting the increasing importance of contraceptive practice in inhibiting potential fertility. Indeed, the change in this index is by far the greatest of any of those shown. While in 1968 proportions married had the largest inhibiting effect, as indicated by the fact that C_m has the lowest value of the four indexes, by 1974 contraception was of equal importance and by 1978 was of considerably greater importance. The index of induced abortion also declines, suggesting that abortion assumed an increasing importance in inhibiting potential fertility during the decade under observation, but this is a result of the largely arbitrary assumptions made about changes in induced abortion rather than being based on solid data. In contrast to the other three indexes, the index of lactational infecundability (C_i) increases in value, reflecting the decline in the duration of breastfeeding. Hence the importance of breastfeeding decreases as an inhibitor of potential fertility.

Given the straightforward multiplicative nature of Bongaarts's accounting scheme, it is a simple matter to estimate what fertility would be in the absence of any one or combination of the indexes. In addition to total fecundity (TF), which represents fertility in the absence of all four of the indexes, Table 43 presents three other measures of potential fertility: total marital fertility (TMF), which represents fertility if all women in the reproductive ages were married, i.e., in the absence of nonmarriage; total marital fertility in the absence of contraception but with abortion (TMFA); and total natural marital fertility (TNMF), which represents total marital fertility in the absence of both contraception and abortion. Total fecundity (TF) then represents total marital fertility in the absence of contraception, abortion, and breastfeeding. All four are easily

TABLE 43 Estimated Value of Selected Fertility Measures, Based on Bongaarts's Model, 1968-78: Thailand

Fertility Measures	Years to Which Estimates Refer			
	1968	1971	1974	1978
Total fertility rate (with breastfeeding, induced abortions, use of contraception, and nonmarriage)	6.12	5.30	4.52	3.38
Total marital fertility rate with breastfeeding, induced abortions, and contraception (TMF = TFR ÷ C_m)	9.23	8.07	7.03	5.49
Total marital fertility rate with breastfeeding, induced abortions (TMFA = TMF ÷ C_c)	10.82	10.96	11.05	10.74
Total natural marital fertility rate with breastfeeding (TNMF = TMFA ÷ C_a)	11.16	11.54	11.97	12.34
Total fecundity rate (TF = TNMF ÷ C_i)	15.18	15.63	15.92	15.43

estimated from the total fertility rate (TFR) and the other indexes as follows:

$$TMF = TFR \div C_m$$
$$TMFA = TMF \div C_c$$
$$TNMF = TMFA \div C_a$$
$$TF = TNMF \div C_i$$

Given the multiplicative relationship linking the measures of potential fertility, graphing them on a semi-logarithmic scale, as in Figure 6, is a convenient way to represent visually the relative importance of the fertility-inhibiting effect of each of the four principal proximate determinants responsible for the decline in total fertility during the decade under observation.

Bongaarts's accounting scheme also permits a decomposition of changes in total fertility into changes in the four principal proximate determinants separately, the remaining proximate determinants taken collectively, and an interaction factor (Bongaarts and Potter, forthcoming: Chapter 5). The decomposition of changes in total fertility between 1968 and 1978 is given in Table 44 and Figure 7. Results are expressed in terms of absolute change in total fertility, percent change, and the distribution of percent change. The results indicate that increases in contraceptive prevalence made a far greater contribution to the decline in total fertility then did any other variable, not only during the entire decade but also during each intersurvey interval. The

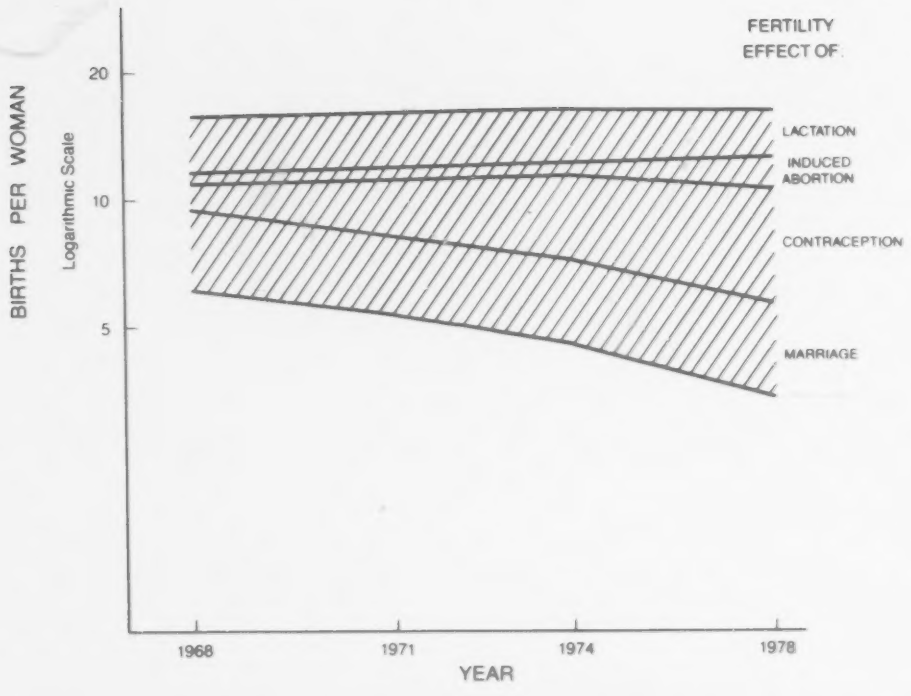


FIGURE 6 Changes in Selected Reproductive Measures Based on Bongaarts's Model, 1968-78: Thailand

Source: Table 43.

contributions to lower total fertility made by the assumed increase in abortion and the decrease in proportions married are of much smaller magnitudes. The results also indicate, however, that fertility would have increased during the decade by almost one fifth due to declining breastfeeding had the other variables remained constant. When the contribution of contraception and abortion are taken together, it is obvious that Thailand's reproductive revolution is largely the product of increasing deliberate marital fertility control with all other factors being of secondary importance.

TABLE 44 Decomposition of the Change in the Total Fertility Rate, Based on Bongaarts's Model, 1968-78: Thailand

Factors Responsible for Fertility Change	Absolute Change in TFR				Percent Change in TFR				Distribution of Change in TFR			
	1968 -71	1971 -74	1974 -78	1968 -78	1968 -71	1971 -74	1974 -78	1968 -78	1968 -71	1971 -74	1974 -78	1968 -78
Proportion of women married	-.06	-.11	-.19	-.43	-0.9	-2.1	-4.2	-7.1	-6.7	-14.3	-16.7	-15.8
Contraceptive practice	-.84	-.72	-.89	-2.45	-13.7	-13.6	-19.7	-40.1	-102.2	-92.5	-78.2	-89.5
Induced abortion	-.13	-.15	-.24	-.61	-2.1	-2.8	-5.4	-10.0	-15.7	-19.0	-21.4	-22.3
Postpartum infecundability	+.02	+.10	+.27	+.51	+0.4	+1.9	+6.0	+8.4	+3.0	+12.9	+23.8	+18.8
Other proximate determinants	+.18	+.10	-.14	+.10	+3.0	+1.9	-3.1	+1.6	+22.4	+12.9	-12.3	+3.6
Interaction	-.01	.00	+.05	+.15	-0.1	0.0	+1.2	+2.4	-0.7	0.0	+4.8	+5.4
Total	-.82	-.78	-1.14	-2.74	-13.4	-14.7	-25.2	-44.8	-100	-100	-100	-100

Note: Due to rounding, sum of individual factors may not add up to total.

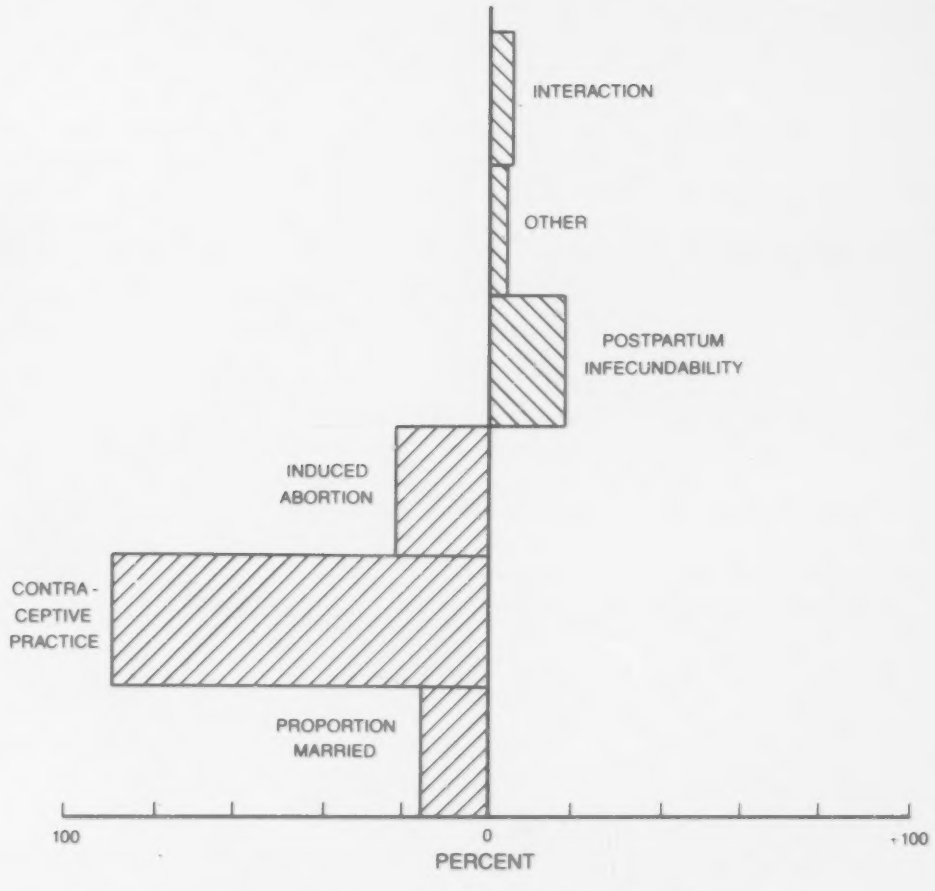


FIGURE 7 Decomposition of the Change in the Total Fertility Rate Based on Bongaarts's Model, 1968-78: Thailand

Source: Table 44.

CHAPTER 7

ATTITUDES TOWARD FAMILY SIZE, SEX COMPOSITION, AND FERTILITY CONTROL

Many of the studies reviewed in the previous chapters that provided behavioral data on fertility and birth control practices also attempted to explore preferences for family size and sex of children as well as attitudes toward fertility control with regard to both contraception and abortion. In this chapter we review the evidence from these studies and several others regarding desired family size, preferences for the sex composition of families, and attitudes toward birth control, including abortion. We do not include in this chapter, however, any extensive examination of the detailed attitudinal data that have been collected on the value and disvalue of children, available from the international Value of Children Study in which Thailand participated and to a lesser extent from the husband survey component of SOFT. Such a task is beyond the more limited scope of the present study as we have defined it.

DESIRED FAMILY SIZE

Attempts to measure family-size preferences in developing countries have been incorporated in so-called KAP surveys (meaning Knowledge of, Attitudes toward, and Practices of family planning) since their inception. While a variety of more sophisticated approaches have been developed to measure family-size preferences, undoubtedly the most common source of such information is a relatively simple question asking for the number of children the respondent would have if he or she could have just the number wanted. In cases where the respondents are married, the question often is phrased in terms of how many children the respondents would like to have if he or she were starting

marriage over again. A number of surveys in Thailand included such questions and provide the basis for testing both the level and trend in desired family size over the period of the recent fertility decline.

The meaningfulness of responses to questions on desired family size, particularly in developing countries, have often been questioned. Especially in settings where the practice of birth control is rare or absent, family size may not be thought of as a matter of conscious rational choice and thus questions on desired family size may make little sense to the respondent. In a recent study of birth expectations, Placek and Hendershot (1981) propose a conceptual framework which contrasts situations dominated by fate and those dominated by control. In tne former, many couples may lack the knowledge of birth control, the planning orientation, or the social environment that leads to decision making about fertility, and children are viewed as the inevitable consequence of sexual activity. In contrast, the role of individual decision making becomes more salient as control over the environment and over one's "demographic fate" increases (Back, 1967). A similar argument can be made with regard to fertility preferences. Thus we might expect responses to desired family size questions to become increasingly meaningful with the spread of deliberate family limitation practices.

There is some evidence indicating that concern about limiting family size was not well entrenched in the thinking of much of the population at the onset but that it gained salience during the early stages of the recent fertility decline in Thailand. As part of the Rural Employment Survey in 1969, a sample of men with wives in the reproductive ages in northern Thailand were asked if they had ever discussed with their wives the number of children they wanted or the possibility of using birth control. Only 29 percent said they had ever discussed family size and only 17 percent had discussed the possible use of birth control (Jones and Rachapaetayakom, 1970). Similar questions were asked a sample of married men in the south a year later. Slightly more than a third had discussed family size and 17 percent had discussed birth control (Jones and Soonthornthum, 1971).

In LS1 and LS2 married women respondents were asked whether and how often they had discussed problems of having too many children with their husband, with relatives, or with friends or neighbors. Results are summarized in Table 45. Only a minority of women in LS1

TABLE 45 Percentage Discussing Problems of Excess Fertility Among Married Women in Reproductive Ages, Currently Living with Husband, by Residence: Thailand

	Rural		Urban	
Reference Person and Frequency	LSI 1969	LS2 1972	LS1 1970	LS2 1973
With Husband				
Very Often	8.6	7.3	6.5	10.7
Fairly Often	18.4	20.3	16.0	18.5
Once or Twice	10.9	12.9	23.2	21.2
Never	62.1	59.5	54.3	49.6
Total Percent	100	100	100	100
Total N	952	1,269	1,458	527
With Relatives				
Very Often	4.1	5.4	4.2	--
Fairly Often	15.2	21.6	15.1	--
Once or Twice	9.2	9.2[a]	16.0	--
Never	71.5	63.9	64.8	--
Total Percent	100	100	100	--
Total N	956	1,270	1,459	--
With Friends or Neighbors				
Very Often	4.8	7.7	8.6	--
Fairly Often	16.8	25.7	20.3	--
Once or Twice	10.7	12.8[a]	17.5	--
Never	67.8	53.8	53.7	--
Total Percent	100	100	100	--
Total N	947	1,270	1,455	--

Notes: Totals exclude a small number of respondents coded as don't know, no answer. Reproductive ages were defined as 15-44 in the rural phase of LS1 and 15-49 in all others.

[a]Including a small number of respondents for whom the frequency of discussion is unknown but who indicated that they have discussed problems of excess fertility.

indicated they had discussed this matter with any of the specified reference persons. However, both the proportion who ever discussed such matters as well as the frequency of those discussions apparently increased between the two rounds of the survey, although more than half of rural women still indicated never having had any discussions by the time of LS2. As might be expected, given the lower fertility levels and greater use of contraception among urban women at the time of the surveys, discussions of the problems of having too many

children were more common among urban than rural respondents. Interestingly, for the rural sample, for which such a comparison is possible, the greatest increase in discussions is indicated with friends or neighbors and the least increase with husbands. According to an analysis of the early experience of organized family planning activities in Thailand, such person-to-person communication among friends and acquaintances proved an effective way of recruiting sizable numbers of acceptors (Rosenfield et al., 1973).

Since many of the same respondents were included in LS1 and LS2, the possibility exists that the first round of the survey itself in which questions related to the desired family size and birth control may have stimulated the increased discussion. Results from WRPS, an entirely different survey, however, suggest a continuation of the trend toward heightened salience of fertility limitation concerns. Of the rural sample of women interviewed in 1975, three years after the rural round of LS2, only 47 percent said they had never discussed their desired number of children with their husband. Moreover, this proportion was lower among younger women than older women: 42 percent of women aged 15-29 never discussed this matter with their husbands compared to 52 percent of women aged 30-44 (Deemar Company, Ltd., 1975). Again, this suggests a trend over time toward increased concern about the question of family size.

Several studies have attempted to evaluate the meaningfulness and quality of responses to questions on desired family size in Thailand. One common difficulty with such data, for example, is that many respondents answer the question with vague responses referring to fate, "up to God," and so on, rather than providing a specific number. Based on data from LS1, Knodel and Prachuabmoh (1973) point out that the vast majority of currently married Thai women did provide numerical responses to a question on family-size preferences. (For data on men, see Prachuabmoh et al., 1972:69). The LS1 data show that desired family size increases with age, a relationship found in all Thai surveys as well as typically in surveys in other countries. This undoubtedly reflects to some extent a tendency for respondents to rationalize the number of children they have when stating the numbers they would want if they were recently married. Nevertheless, analysis of LS1 data reveals that the vast majority of respondents indicated a preferred number that was different from the number of living children they had at

the time of interview. Moreover, the large majority of women with five or more living children stated a preferred number that was lower than their actual number of children. These results from LS1 are of particular interest since they refer to a period of time when contraceptive prevalence was still relatively low.

Of course, simply providing a numerical answer to a question on desired family size does not necessarily indicate that the response is meaningful. The very nature of the survey approach may encourage respondents to give numerical responses even if they are not particularly inclined to do so. For example, interviewers might encourage respondents to whom the question made little sense to provide some answer anyway. The findings of Lauro (1979), based on his study of a central Thai village, are interesting in this connection. He posed an open-ended question to villagers about their childbearing preferences and consciously attempted not to encourage numerical responses if they did not come forth spontaneously. Only about a quarter of the villagers responded to the question with exact numbers. However, a number of others were able to state a narrow range or to express a preference in terms of "few" or "many". Altogether, approximately 5 percent were able to give precise numbers or some indication of preferred size. Of those who did not give such responses, about a third, mostly unmarried females, indicated they had never thought about it; another third responded that the number of children they already had was enough; and the remainder indicated they either did not understand the question, did not know, or gave an ambivalent response. His findings thus indicate that very few married respondents said they had never thought about the question, even though this was a permissible answer (as indicated by the substantial number of unmarried women who provided it). Lauro does not provide information about the marital status of those who indicated they did not understand the question, did not know their desired number of children, or were ambivalent. Quite possibly these include a fair number of unmarried respondents as well. Finally, the substantial proportion who responded that the number of children they had was enough suggests that they clearly had some idea of how many children they wanted even if the questioning did not elicit numerical responses. Thus Lauro's results support the idea that Thai villagers currently have conscious desires about family size even if such desires are not necessarily conceptualized as a

single number. It should be noted that contraceptive prevalence was already fairly substantial in the study village at the time of his field work and thus his findings do not tell us the extent to which villagers would have been able to articulate family-size preferences prior to the spread of birth control.

Based on a comparison of responses in LS1 and LS2 for respondents included in both surveys, Knodel and Piampiti (1977) calculated the reliability ratios for a number of variables, including desired family size. The reliability ratio is intended to indicate the proportion of respondents giving the same answer after allowing for the fact that there would be some agreement simply by chance. The results indicate fairly low levels of individual consistency. Nonrandom consistency ranged from 19 percent for rural women to 29 percent for urban male household heads. Even so, responses on desired family size showed greater consistency than most other attitudinal variables, although considerably lower consistency than for most behavioral variables. Moreover, among rural women, urban women, and urban household heads, the majority of respondents who stated different ideal family sizes in the two survey rounds deviated by only one child in either direction. Only among rural household heads was the average discrepancy greater than one child. Viewed in this way, the amount of inconsistency seems considerably more moderate; also, allowances should be made for genuine change, given the three-year interval between the two surveys.

In the AFPH survey, women were not only asked the standard question on desired family size but were also asked a hypothetical question on the number of children they would recommend a daughter to have. Presumably the latter question would be less affected by attempts to rationalize the respondent's own existing number of children. The results of these two questions are compared in Table 46 by age of respondent. While for both questions the mean number of preferred children increases with age, at every age the number stated for the daughter is lower than for the respondent herself. The fact that this difference increases substantially with age strongly suggests that at least part of the increase with age in preferred number of children for self is due to rationalization of the number of living children. Possibly, the change in the recommended number of children for daughters with age is also a product of rationalization, although it could also reflect a trend toward smaller desired family sizes over time.

TABLE 46 Preferred Number of Children for Self and for Daughter, by Age and Residence, Currently Married Women Aged 15-44, 1979: Thailand

Age	Rural			Urban			Total		
	For Self	For Daughter	Difference	For Self	For Daughter	Difference	For Self	For Daughter	Difference
15-19	2.60	2.52	.08	(2.30)	(2.45)	(.15)	2.58	2.52	.06
20-24	2.72	2.68	.04	2.64	2.52	.20	2.72	2.66	.06
25-29	2.99	2.75	.24	2.89	2.70	.29	2.99	2.75	.24
30-34	3.41	2.88	.53	2.99	2.73	.69	3.38	2.87	.51
35-39	3.59	3.00	.59	3.06	2.89	.70	3.56	2.99	.57
40-44	3.64	3.01	.63	3.44	2.94	.70	3.62	3.00	.62
Total									
Unstandardized	3.19	2.82	.37	2.94	2.72	.22	3.15	2.81	.34
Unstandardized for age	3.21	2.83	.38	2.94	2.73	.21	3.19	2.82	.37

Notes: The results refer to a sampling universe of 20 provinces; the urban sample refers to provincial urban only. The distribution of currently married women for the whole country as reported in the 1970 census was used as the basis for the age standardization. Results in parentheses are based on fewer than 50 cases.

Source: AFPH.

Trends in family-size preferences are indicated in Table 47, which shows the mean preferred number of children across successive surveys for both married women and their husbands. In addition, separate results are shown for married women under age 25, on the assumption that the responses of younger married women are less affected by rationalization since most are still at an early stage of family building. Moreover, responses from the younger women should reflect the most recent trends in family-size preferences and thus be more indicative of fertility developments in the near future as these women pass through their remaining childbearing years. However, some caution is warranted when examining results for the younger women, since those who married at younger ages may not be representative of all women who eventually marry by the end of the reproductive span.[1]

The mean preferred number of children declined substantially during the period under observation both for women aged 15-44 and for women under 25. In each survey, the mean preferred number of children is lower for the younger women, but the declines are quite parallel, so the difference of about half a child indicated at the time of LS1 is still evident more than a decade later. Likewise, in every survey the number of children preferred by husbands is consistently higher than for their wives, but it declines in a remarkably parallel fashion. Both rural men and women consistently expressed higher preferred numbers of children than their urban counterparts throughout the period. In the countryside as well as in towns, younger women since 1979 indicated they want fewer than three children on the average, suggesting that fertility rates in the future should continue to decrease.

The mean preferred number of children remained constant for rural women between 1969 and 1972 and declined by only one tenth of a child for rural husbands, despite the fact that contraceptive usage increased substantially and marital fertility declined during the same period. Moreover, desired family size among currently married women aged 20-44 in the Potharam district was 3.8 in 1964 and 4.0 in 1965, thus averaging 3.9 or exactly the same as the figure for rural women reported approximately five years later in LS1 (Hawley and Prachuabmoh, 1971a:77).

The Thai experience is roughly similar to that of Taiwan and Korea, where initial increases in contraceptive practice and decreases in fertility took place in the absence of any noticeable concomitant change in desired

TABLE 47 Preferred Number of Children Among Currently Married Women Aged 15-44, and Husbands of Currently Married Women Aged 15-44, Standardized by Age, and Among Currently Married Women Under 25, by Place of Residence: Thailand

	LS1 1969/70	LS2 1972/73	SOFT 1975	NS 1979	AFPH[a] 1979	CPS2 1981
Rural						
Women 15-44	3.9	3.9	3.7	3.3	3.2	3.0
Husbands	4.3	4.2	3.8	3.5	--	--
Women under 25	3.4	3.4	3.1	2.9	2.7	2.6
Urban						
Women 15-44	3.6	3.4	3.3	3.0	2.9	2.5
Husbands	3.8	3.6	3.5	3.2	--	--
Women under 25	3.0	2.9	2.9	2.8	2.6	2.2
Total						
Women 15-44	3.8	3.8	3.6	3.3	3.2	2.9
Husbands	4.2	4.1	3.8	3.4	--	--
Women under 25	3.3	3.3	3.0	2.8	2.7	2.5

Notes: The age distribution of currently married for the whole country as reported in the 1970 census was used as the basis of the age standardization. Results for husbands were standardized based on their wife's age.

[a]Results refer to a universe of 20 provinces; the urban sample is provincial urban only.

Sources: Knodel et al. (1980); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

family size; only after these changes had gained some momentum was an accompanying decline in the preferred number of children observed (Freedman et al., 1974; Ross and Kap Suk Koh, 1977). In all three countries the stated preferred number of children was substantially below the number of living children women had by the end of their childbearing years.

The experience of these countries as well as Thailand suggests that fertility desires may respond to the spread of family planning practices rather than vice versa. One possible interpretation of such a lag in attitudinal change relative to behavioral change is that only after the concept of family planning becomes widely known and contraceptive practice reaches a moderate level is it realistic for couples to start adjusting their preferred number of children downward. In the Thai experience, this situation may have been reached before 1970 among

urban women, thus permitting a steady decrease in the mean preferred family size over the period under observation. In the rural areas, where contraceptive knowledge was much more limited and contraceptive practice minimal at the beginning of the period, a short time lag may have been required before fertility desires started to decline in response to an increasing awareness of the possibility of limiting family size.

The distribution of responses to the question on family-size preferences as reported in LS1 and in the three most recent surveys reveals that a substantial change occurred over the decade (see Table 48). At the time of LS1, the majority of both rural and urban currently married women in the reproductive ages reported a desired family size of four or more children for themselves. This has decreased substantially while the proportion who expressed a preference for two or three children increased considerably. By 1981, a substantial majority of women indicate two or three as the desired number. Presumably the effect of rationalization of existing number of children on desired family size is minimized in the data on preferred number of children by women under 25 as well as in the data on the number of children that women in all reproductive ages would recommend for a daughter. In these cases, a modal preference for two children is clearly apparent both for rural and urban women. All surveys point to a clear avoidance of preferences for zero or one child. In both of these respects, family-size preferences among Thai women resemble those expressed recently in the United States.

The modal preference for two children is supported by evidence from other sources as well. In all three AMS subsamples of currently married women--in Bangkok generally, in a Bangkok slum, and in a semi-rural area--two children was also the most frequently expressed preference. Lauro (1979) also found that two was the most frequently cited preferred number of children in response to the open-ended question he used in his central Thai village study. In his study of unmarried adolescents, Muangman (1979) indicates that two was clearly the dominant preferred number of children.[2] Two was not only the modal preference but was the number stated by the majority (57 percent) of those who expressed a preference.

Table 49 shows the average preferred number of children by age of respondent among currently married

TABLE 48 Percent Distribution of Preferred Number of Children for Self and for Daughter Among Currently Married Women Aged 15-44 (and under 25), by Place of Residence: Thailand

Residence and Preferred Number of Children	For Self, Women 15-44				For Self, Women Under 25			For Daughter, Women 15-44[a]
	LSI 1969/70	NS 1979	AFPH[b] 1979	CPS2 1981	LSI 1969/70	NS 1979	CPS2 1981	AFPH[b] 1979
Rural								
0-1	5.2	2.3	4.0	6.0	8.5	2.1	6.3	3.3
2	18.2	29.7	29.7	34.1	27.1	47.0	47.2	39.6
3	21.0	22.8	32.0	31.3	22.6	20.6	31.9	34.6
4+[c]	55.5	45.2	34.3	28.6	41.8	30.3	14.7	22.5
Total	100	100	100	100	100	100	100	100
Urban								
0-1	3.9	4.4	4.8	10.1	7.2	2.1	15.0	3.2
2	21.2	34.5	34.2	46.6	29.8	53.2	51.0	40.8
3	23.5	22.6	34.3	27.3	27.5	17.0	27.7	38.9
4+[c]	51.3	38.5	26.8	16.0	35.5	27.7	6.3	17.1
Total	100	100	100	100	100	100	100	100
Total								
0-1	5.0	2.7	4.1	6.7	8.2	2.1	7.6	3.4
2	18.7	30.5	29.9	36.3	27.6	47.9	47.8	39.7
3	21.5	22.8	32.2	30.6	23.5	20.1	31.2	34.9
4+[c]	54.8	44.0	33.8	26.4	40.7	29.9	13.4	21.9
Total	100	100	100	100	100	100	100	100

[a]Including a small number of women 45 or older.
[b]Refers to a universe of 20 provinces; urban refers to provincial urban only.
[c]Including "as many as possible."

Source: Results for the CPS2 in part from Kamnuansilpa et al. (1982).

TABLE 49 Preferred Number of Children by Age and Place of Residence, Currently Married Women, Aged 15-44: Thailand

Age Group	Rural			Urban		
	LS1 1969	SOFT 1975	NS 1979	LS1 1970	SOFT 1975	NS 1979
15-19	3.67	2.90	2.84	2.93	(2.67)	--
20-24	3.29	3.14	2.86	3.04	2.89	(2.87)
25-29	3.78	3.43	3.15	3.38	3.21	2.57
30-34	3.86	3.95	3.45	3.82	3.26	3.23
35-39	4.33	4.02	3.75	3.91	3.49	3.39
40-44	4.33	4.10	3.65	4.14	4.13	3.50
45-49	--	4.60	4.16	3.87	(4.35)	(3.61)

Notes: Results based on at least 10 but fewer than 50 cases shown in parentheses; results based on fewer than 10 cases not shown.

women for three national surveys spanning the last decade. For each survey the desired family size increases with age for both rural and urban women and undoubtedly reflects the increasing importance of rationalization as women's actual family size increases. A comparison of the same age group across the three surveys reveals a pervasive decline in the desired family size regardless of age. Moreover, the magnitude of the decline shows little association with age.

We can approximate the experience of specific cohorts as they aged over the decade by comparing successive age groups across three surveys. As discussed in connection with similar comparisons with respect to contraceptive prevalence and expected number of children, some caution is required when interpreting results in this manner. In particular, problems arise because of sample fluctuation, selection for early marrying members of one cohort for younger age groups, and deviations from five-year multiples in the interval between the surveys. Contrary to the impression given by the cross-sectional association between age and desired family size, there are only limited instances of increases with age for particular cohorts. Indeed, desired family size is as likely to decline as to increase between the two surveys for any particular set of successive age groups. Apparently the declining trend in fertility desires over the period was

sufficient to counteract the tendency for desired family size to increase with age as a result of rationalization. The sharp increases in contraceptive prevalence with age for the same cohort, as indicated in the previous chapter, undoubtedly resulted in lower increments in family size with age than in the past. This in itself would also reduce the extent to which rationalization would lead to an increase in desired family size with age for the cohort experience compared to the cross-sectional age pattern.

GENDER PREFERENCES

Anthropological studies make clear that children of both sexes are valued in Thailand although to some extent for different reasons. Only a son can serve time in the Buddhist monkhood, an action thought to bring considerable merit to his parents and a reason frequently cited as underlying the importance of having a son. On the other hand, in much of rural Thailand, couples typically reside with the wife's parents immediately following marriage, thus adding the labor of the son-in-law to that of the household. While such co-residence is often temporary, it is common for the youngest daughter in the family to live with her husband in the parental household permanently, to take care of her parents in their old age and eventually to inherit the house (Smith et al., 1968:120; de Young, 1966:23; Foster, 1975, 1978). Thus we might expect that many couples will feel it is important to have at least one child of each sex. In his study of a central Thai village, Riley (1972) points out that many women when asked about their ideal family size said they wanted two children and then volunteered the information "one boy and one girl." Although some anthropologists report son preference (e.g., Kingshill, 1960:187), more frequently they note that there is a lack of strong preference for sons (Hanks and Hanks, 1963; Blanchard, 1958:435). Occasionally, a preference for daughters is even suggested (Mougne, 1974, Part 3:19; Potter, 1976:127; Kemp, 1970:83).

In a comparative study of gender preference based on the Value of Children Study, Kuo (1980) judged the level of son preference to be intermediate in Thailand, below that characteristic of Korea or Taiwan but stronger than the Philippines or Indonesia. The data also confirm the impression of anthropologists that sons and daughters are valued to some extent for different reasons.

Statistical evidence on preferences for the sex composition of families has been examined in two studies based on LS1 and LS2 (Prachuabmoh et al., 1974; Knodel and Prachuabmoh, 1976). In this section we review some of the findings from these studies and update them with data from NS and, to a lesser extent, CPS2. In all but CPS2, both male household heads and married women were interviewed, thus permitting a comparison of gender preferences among men and women.

In the urban round of LS2 and NS, respondents were not only asked about their preferred number of children but also were asked how many children of each sex they would like to have if they could have just the number they wanted. Responses to these questions provide direct evidence on the preferred sex composition of the desired number of children. Analysis of these data must be limited to those respondents who were able to state not only a desired family size but to specify the number of sons and daughters they wanted. Fortunately, this includes the vast majority of respondents. Nevertheless, it should be recognized that some respondents who stated a desired family size but not a desired number of sons and daughters probably had no strong preferences regarding the sex of their children.

The percent distribution of desired number of sons and daughters is shown in Table 50 for currently married women in reproductive ages and for male household heads with wives in the reproductive ages. For both men and women in the sample and for both residence categories, the mean number of desired sons exceeds the mean number of desired daughters. The sex ratio of desired sons to desired daughters is substantially higher for men, however, than for women respondents, thus indicating a substantially stronger son preference among males. Similar results were also obtained in the Value of Children Study done in 1976: the sex ratio of desired children indicated by wives was 1.16 and by husbands was 1.39 (Kuo, 1980).

For both men and women in the NS sample, the ratio of desired sons to desired daughters is higher for the urban population, although the difference is much greater for males than for married women. This urban-rural difference undoubtedly results mainly from the substantial proportion of ethnic Chinese in the urban sample. Analysis of the urban round of LS2 indicates that the sex ratio of preferred children for ethnic Chinese women was 1.25 compared to 1.10 for ethnic Thai women and 1.50 for

TABLE 50 Percent Distribution of Desired Number of Sons, Desired Number of Daughters, and Ratio of Desired Number of Sons to Daughters, by Residence, Among Currently Married Women Aged 15-44: Thailand

	Urban				Rural	
	LS2 1973		NS 1979		NS 1979	
Desired Number	Sons	Daughters	Sons	Daughters	Sons	Daughters
Among Married Women						
0	3.0	5.3	2.1	6.0	1.7	2.4
1	34.3	41.8	43.4	50.2	39.4	46.8
2	47.6	44.9	43.8	38.1	45.4	40.6
3+	15.2	8.0	10.7	5.7	13.5	10.2
Total percent	100	100	100	100	100	100
Mean number	1.81	1.58	1.68	1.45	1.78	1.61
Sex ratio (m/f)	1.15		1.16		1.10	
Total N	1,248		281		1,315	
Among Male Household Heads						
0	1.7	7.1	0.7	11.5	0.5	4.9
1	20.4	44.9	28.1	44.6	32.0	44.9
2	51.3	39.0	51.1	41.0	46.1	39.3
3+	26.3	9.0	20.1	2.9	21.4	11.0
Total percent	100	100	100	100	100	100
Mean number	2.61	1.54	2.11	1.36	2.01	1.63
Sex ratio (m/f)	1.40		1.55		1.23	
Total N	879		139		844	

Note: Respondents not stating numerical responses to questions on the desired number of sons and daughters are excluded from the table.

Source: LS2 results from Knodel and Prachuabmoh (1976).

ethnic Chinese male household heads compared to 1.36 for ethnic Thai household heads (see Knodel and Prachuabmoh [1976] for a discussion of definitions of ethnic Chinese in urban Thailand). Thus the sex ratio of desired children for urban ethnic Thais in LS2 is quite similar to results for rural respondents in NS, of whom only a small proportion would be ethnic Chinese. Results from the FPHH study for a large sample of married women in the northeast, the vast majority of whom were residing in rural areas, indicate a similar sex ratio of 1.11 for the reported desired number of sons and daughters (Porapakkham and Bennett, 1978:104-105).

Although a distinct son preference is apparent for male respondents, only a very small percentage of either men or women indicate they wish to have no daughters.[3] The sex ratio of desired children depends quite strongly on the total number of desired children. As Table 51 shows, respondents who wanted an even number of desired children overwhelmingly indicated an equal number of

TABLE 51 Percent Distribution of Desired Number of Sons, by Residence and Desired Number of Children Among Currently Married Women Aged 15-44, and Male Household Heads with Wives Aged 15-44 Who Expressed Desired Family Sizes of Five or Fewer Children, 1979: Thailand

Residence and Desired Number of Children	Married Women: Desired Number of Sons 0	1	2	3+	Total Percent	N	Male Household Heads: Desired Number of Sons 0	1	2	3+	Total Percent	N
Rural												
1	42	58	--	--	100	19	10	90	--	--	100	10
2	2	96	3	--	100	397	0	92	8	--	100	213
3	2	34	63	1	100	297	0	26	70	3	100	202
4	0	4	88	8	100	405	1	2	85	11	100	245
5	1	4	37	59	100	112	0	7	22	71	100	90
Urban												
1	40	60	--	--	100	10	--	--	--	--	--	2
2	1	91	8	--	100	101	3	80	17	--	100	30
3	2	35	62	2	100	63	0	26	68	6	100	50
4	0	3	90	8	100	79	0	0	86	14	100	36
5	0	0	20	80	100	15	0	0	9	91	100	11

Notes: Respondents not stating numerical responses to questions on the desired number of sons and daughters are excluded from this table. Totals of percents may differ from 100 due to rounding.

Source: NS.

desired sons and daughters, while those who expressed an odd number of desired children were very likely to indicate a preference for more sons than daughters. Thus when couples express a desired family size of two--which appears, by the trends presented above, to be increasingly the case--they are typically thinking in terms of one son and one daughter. A preference for one child of each sex characterizes men almost as much as women and may help explain why very few respondents expressed a desired family size of fewer than two children.

Even when we combined respondents stating odd and even family sizes, results from NS show that the majority of both rural and urban women and rural men prefer equal numbers of sons and daughters, as shown in Table 52. Only among urban males do less than a majority opt for equal numbers of children of each sex. Clearly, however, when unequal numbers of sons and daughters are desired, respondents are more apt to opt for more sons than for more daughters. In brief, the attitudinal data on gender preferences suggest that some moderate son preference coexists with a more dominant preference for a balanced sex composition. Moreover, son preference is clearly stronger among men than among women.

Indirect evidence on the pattern of gender preferences in Thailand is provided in Table 53, which compares the

TABLE 52 Percent Distribution of Sex Composition Preferences by Residence Among Currently Married Women Aged 15-44, and Male Household Heads with Wives Aged 15-44: Thailand

	Married Women		Male Household Heads	
Preference (in percent)	Rural	Urban	Rural	Urban
More daughters than sons	15.1	12.8	11.7	11.5
Equal numbers	59.1	60.5	52.8	39.6
More sons than daughters	25.9	26.7	35.4	48.9
Total percent	100	100	100	100
Total N	1,315	281	844	139

Note: Respondents not stating numerical responses to questions on the desired number of sons and daughters are excluded from this table.

Source: NS.

TABLE 53 Percent Not Wanting Additional Children by Number and Sex Composition of Living Children and by Residence Among Currently Married Women Aged 15-44, and Among Male Household Heads with Wives Aged 15-44, with Two or Three Living Children: Thailand

Number of Living Children and Sons	Rural						Urban					
	Married Women				Male Heads		Married Women				Male Heads	
	LS1 1969	LS2 1972	NS 1979	CPS2 1981	LS2 1972	NS 1979	LS1 1970	LS2 1973	NS 1979	CPS2 1981	LS2 1973	NS 1979
Two Children												
No son	(26)	(41)	41	52	(46)	(47)	32	38	(60)	67	(43)	--
1 son	52	53	64	71	64	64	45	49	(76)	76	58	(73)
2 sons	(59)	(41)	54	55	(58)	(66)	(35)	26	(38)	72	(54)	(40)
Three Children												
No son	(72)	(62)	(79)	71	(61)	(71)	(42)	(48)		(78)	(67)	
1 son	(75)	70	66	86	76	82	60	69		88	78	
2 sons	63	77	80	85		74	63	73			89	
3 sons	(64)	(67)	(69)	76		(88)	(56)	(61)			87	

Notes: Couples who were sterilized but not asked if they desire more children are assumed not to want more. Results based on 10-49 cases shown in parentheses; results based on fewer than 10 cases not shown.

Sources: LS1 results from Prachuabmoh et al. (1974); LS2 results from Knodel and Prachuabmoh (1976);
CPS2 results from Kamnuansilpa, et al. (1982).

percentage not wanting additional children according to the sex composition of the family at the time of the survey. Since most of the respondents indicated a preference for either two or three children, analysis is limited to respondents with two or three living children. Results for both rural and urban married women with two children are consistent in showing that those with a balanced composition are the most likely to indicate they wish to stop childbearing. Among women with three children, the results are less clear but generally point to those with at least one child of each sex being more likely to want to stop childbearing than are women with all three children of the same sex. When women with two or three children who have all sons are compared with those who have all daughters, there is some tendency for high percentages of those with all sons to indicate a desire to stop childbearing, although several exceptions are apparent.

Results for male heads are reasonably consistent in indicating that those with two or three children and no sons are the least likely to want to stop childbearing. Apparently the desire to have at least one son is more pronounced for males. Results are rather mixed with regard to whether men with at least one son and one daughter or those with all sons are more likely to indicate that they wish to have no more children. In general, the results are reasonably consistent with the attitudinal data on desired number of sons and daughters, that is, they indicate a dominant preference among women for balance in the sex composition of children and a stronger son preference among men than among women.

Additional evidence of a pervasive desire for at least one child of each sex is provided by data from SOFT. Among currently married "exposed" women with two living children who wanted another child, all of those with no sons preferred their next child to be a son while only 2 percent of those with two sons did; in addition, exactly half of those with a son and a daughter preferred their next child to be a son (Institute of Population Studies and National Statistical Bureau, 1977, Volume II, Table 3.2.2A).

If preferences for sex composition of offspring have a measurable impact on fertility, then we would expect the practice of contraception to be related to the number of sons and daughters a couple already has (Freedman and Coombs, 1974). The results in this regard, presented in Table 54, do not show an entirely consistent pattern.

TABLE 54 Percent Currently Practicing Contraception by Number and Sex Composition of Living Children, by Residence, Among Currently Married Women Aged 15-44 with Two or Three Living Children: Thailand

Number of Living Children and Sons	Rural LS1 1969	Rural LS2 1972	Rural NS 1979	Rural CPS2 1981	Urban LS1 1970	Urban LS2 1972	Urban NS 1979	Urban CPS2 1981
Two Children								
No son	(4)	(22)	49	60	27	44	(87)	71
1 son	10	30	65	70	28	44	(88)	76
2 sons	(9)	(21)	55	65	18	44	(47)	69
Three Children								
No son	(33)	(52)	(67)	57	33	(43)	(74)	(78)
1 son	(18)	36	57	68	41	54		79
2 sons	13	31	69	68	43	65	(70)	81
3 sons	(7)	(33)	(50)	65	(42)	(49)		(90)

Note: Results based on 10 to 49 cases shown in parentheses; results based on fewer than 10 cases not shown.

Sources: LS1 results from Prachuabmoh et al. (1974); LS2 results from Knodel and Prachuabmoh (1976); CPS2 results from Kamnuansilpa et al. (1982).

Among rural women with two children in all surveys, and to a lesser extent among urban women, those with one son and one daughter were the most likely to be practicing contraception. Such a pattern is consistent with a preference for a balance of children of each sex. Both rural and urban women with three children, however, show little consistency in the relationship between contraceptive practice and number of sons.

One problem with using tabulations such as those in Tables 53 and 54 as indicators of the influence of sex preferences on fertility is that they ignore the heterogeneity of preferences within the population. As Tables 51 and 52 demonstrated, there is some variety in the preferred sex composition of families, although the extent of heterogeneity may be somewhat exaggerated due to rationalization.[4] To the extent that couples at a given parity have different preferences for combinations of sons and daughters, differences in the percentage not wanting more children or practicing contraception among those with different combinations of living sons and daughters would be reduced compared to a situation where

everyone shared the same sex composition preference (McClelland, 1979). In order to avoid this problem, we have compared the stated desired number of sons and daughters with the actual number of sons and daughters and classified respondents who had exactly the number of children they said they wanted according to whether or not the combination of sons and daughters was as they said they wanted. The fact that there is a considerably higher proportion of respondents whose actual and preferred sex composition of children agreed than would be expected by chance indicates that some rationalization of the existing sex composition exists. Couples that had not yet reached the desired number of children or who had exceeded the desired number were placed in separate categories.

The comparison of these categories with respect to the percentage of respondents in them who wanted no more children (both for married women and male heads of households) and with respect to the percentage using contraception (for married women) are shown in Table 55 for respondents with two, three, and four living children. Of particular interest is the comparison among women whose desired and actual number of children are the same, between those who also achieved their preferred sex compositions, and those who did not. In general, both for married women and for male heads of households, those who have both the desired number and desired combination of sons and daughters are more likely to indicate that they want no more children than those who have the desired number but not the desired sex composition. The differences, however, are not large, except for women with two children. Interestingly, it is only among women with two children that contraceptive use is higher among those who have both the desired number and sex composition than among those who have the desired number but not the desired sex composition. For women with three or four living children, the difference between these two groups is small and in the opposite direction from that expected. Thus it appears that it is mainly among couples who want two children that not having the desired sex composition leads to an additional child.

A more detailed analysis (not shown) reveals that virtually all the respondents who prefer two children but do not have their desired sex composition have either all sons or all daughters. Although the small number of cases precludes firm conclusions, the results suggest that some proportion of these respondents are motivated to go on to have an additional child in hopes of having

TABLE 55 Percent Wanting No More Children and Percent Currently Practicing Contraception, by Number of Living Children and Whether the Number and Sex Composition of Living Children Corresponds to the Desired Number and Sex Composition, Among Currently Married Women Aged 15-44 and Male Household Heads with Wives Aged 15-44, with Two, Three, or Four Living Children: Thailand

Comparison of Living Children with Desired Number and Sex Composition	Percent Wanting No More Children						Percent Using Contraception		
	Married Women by Living Children			Female Heads by Living Children			Married Women by Living Children		
	2	3	4	2	3	4	2	3	4
Number not reached	33	46	(50)	39	65	(54)	52	44	(53)
Number but not sex composition reached	(66)	(91)	93	(85)	(93)	(91)	62	(77)	68
Both number and sex composition reached	95	95	99	91	(93)	(98)	79	73	66
Number exceeded	--	91	97	--	(88)	(93)	--	79	76

Notes: Results based on 10 to 49 cases are shown in parentheses; results based on fewer than 10 cases not shown. Respondents not stating numerical responses to questions on the desired number of sons and daughters are excluded from this table.

Source: NS.

one of the opposite sex, particularly if they have no sons. Of respondents who have three or more children, the motivation not to go beyond the desired number seems to largely overwhelm sex composition considerations.[5] Finally, the fact that a considerable proportion of respondents whose number of living children is less than the preferred number of children nevertheless indicate that they wish to have no more children underscores the hypothetical nature of the question on preferred number of children. Quite possibly, respondents are thinking in terms of an ideal situation in which constraints on the number of children are much less than they feel actually exist in their current situation.

In sum, the direct and indirect evidence on gender preferences in Thailand suggests that there are differences in the attitudes of husbands and wives; that the dominant preference is probably for at least one child of each sex; that there is also some son preference, especially among men; and that avoidance of exceeding the desired family size is more important that achieving a desired sex composition, except perhaps for a sizable proportion of those who wish to have one son and one daughter initially but whose first two children are of the same sex. The evidence is also consistent with the suggestion that the desire for both a son and a daughter tends to set a lower limit on the extent to which family size can decline.

ATTITUDES TOWARD BIRTH CONTROL

A number of different questions have been included in the various surveys that have attempted to determine the attitude of the Thai population toward the use of deliberate fertility control within marriage. In general, they indicate overwhelming approval of the use of contraception but at least an overt disapproval of abortion.

Buddhism as adhered to in Thailand apparently presents no obstacles to the acceptance and practice of contraception and in some respects may indirectly facilitate it. Buddhism contains no scriptural prohibitions against contraception nor is Buddhist doctrine particularly pronatalist (Ling, 1969). Thai Buddhism stresses the role of the individual in seeking his or her own liberation which may indirectly contribute to tolerance and acceptance of practices designed to control the individual's fertility (Lauro, 1979).

Several recent studies of Buddhist monks confirm that there is little religious opposition to contraception. Among a reportedly representative national sample of almost 2,000 monks, 83 percent indicated they were supportive of the government's pro-family planning policy and only 5 percent indicated they were not supportive, with the remainder not having an opinion (Muangman and Hirunraks, 1980). The same study found that almost four out of five monks agreed that married couples should practice family planning and only 6 percent disagreed (Kanchanasinith et al., 1980). In the same study, 100 Muslin imams were also interviewed. Approval was slightly lower among the imams although still quite high, with 71 percent agreeing and 10 percent disagreeing that married couples should practice family planning.

Lay persons also apparently do not feel that contraception is against their religion. Among a sample of married men in southern Thailand, results of a 1970 survey indicate that 86 percent of Buddhists and 82 percent of Moslems said contraception was not against their religion; only 20 percent of the Buddhists and 6 percent of the Moslems said contraception was counter to their religions, with the remainder not indicating an opinion (Jones and Soonthornthum, 1971).

Religious objections to abortions are quite different. In particular, the Buddhist proscription against taking life appears to directly contravene abortion (Ling, 1969). The study of religious leaders found that 98 percent of both the monks and imams perceived induced abortion as being against religious doctrine. Nevertheless, as Lauro (1979:267) points out, the moral issue of abortion is confounded by the general Buddhist notion that the seriousness of taking a life increases with the size and complexity of the life being taken and by the general cultural proclivity for leaving decisions to individuals.

Given the rapid increase in contraceptive prevalence over the last decade, it is hardly surprising that Thais are favorably disposed toward the idea of family limitation and the practice of birth control within marriage. Lauro (1979:230-231) was impressed, even surprised, at the pervasiveness and depth of interest in matters of modern birth control among women in the central Thai village in which he did his fieldwork. However, anthropological accounts based on fieldwork prior to the recent upsurge in birth control activity would probably not have led one to expect that the Thai population would be so willing to adopt family planning practices. On the other

hand, the Potharam Study conducted in 1964 did clearly point to fairly widespread interest in family planning and motivation to control fertility in that rural district (Hawley and Prachuabmoh, 1971b). This finding has been confirmed in the national studies that took place later.

In the Potharam Study and both rounds of LS, respondents were asked the following rather typical question used in KAP surveys about their attitude toward the idea of family planning: "If you knew of a simple and harmless way to avoid becoming pregnant too often or having too many children (more than you want) or having children too close together, would you be in favor of a married couple using such a method?" The purpose of the question was to define the basic idea of family planning for the respondents, in case the concept was foreign to them, and then to elicit approval or disapproval. The question is indirect in that it does not mention family planning or contraception per se and indeed is rather cumbersome. There is ample evidence that the wording of the question may have led to some confusion in interpreting its meaning on the part of respondents. For example, in the Potharam Study, some women indicated disapproval in response to the question and yet indicated in response to another question that they wanted to do something to regulate the number of children they had and wanted to learn about methods of family planning (Hawley and Prachuabmoh, 1971b:33). In LS1, substantial proportions of women who indicated they did not approve of family planning in response to this question were themselves currently practicing or intending to use contraception (Knodel and Pitaktepsombati, 1973).

While results from LS1 indicated that the majority of married women in reproductive ages expressed approval in response to this question, close to a third of rural women and about one in four urban women indicated they did not approve (Knodel and Pitaktepsombati, 1973). The approval rate was about the same for rural women in LS2 three years later but showed a noticeable increase for urban women (Knodel and Pitaktepsombati, 1975). Nevertheless, approximately 18 percent of ever-married urban women who expressed a definite opinion indicated disapproval in response to this indirect question. A direct question, however, was also included in the urban phase of LS2; it asked simply: "Do you approve of family planning?" About 40 percent of ever-married women indicated they either did not understand the question or were coded "don't know, no answer." Of those who pro-

vided a definite opinion, 93 percent indicated approval and only 7 percent indicated disapproval. Moreover, of those who indicated disapproval to the indirect question, only 11 percent indicated disapproval to the direct question; twice a many indicated approval, and the large majority either indicated they did not understand or were coded "don't know, no answer." It is also interesting to note that the percent indicating incomprehension or giving no answer to the direct question increased sharply with age from less than one in four for ever-married women under 30 to half of women aged 45-49 and well over half for older women. This may reflect a time trend in which recent cohorts entering the reproductive years were increasingly aware of the concept of deliberate fertility control within marriage.

In the urban phase of LS2, male household heads were also asked a direct question about their approval of family planning and in addition were asked whether they approved of their wives practicing family planning. Although a substantial minority indicated they did not understand the question or did not provide an explicit opinion, of those who did, well over 90 percent indicated approval to both questions.

For the reasons discussed above, we believe that the responses to the standard indirect question tend to underestimate the extent of approval or at least receptivity to the idea of family planning in Thailand in these earlier surveys and that the vast majority of respondents who understood the concept approved of it. In subsequent surveys, direct questions were asked typically, as it was no longer felt that the concept of family planning needed to be explained, given the rapid increase in knowledge of contraceptive methods and prevalence of contraceptive use. Results from several of these surveys are indicated in Table 56 and are consistent in indicating the widespread approval of birth control among both men and women and in both rural and urban sectors of the population.[6]

An even more consistent finding in survey results in Thailand is an overt disapproval of abortion, except under special circumstances. More than 90 percent of women interviewed in the Potharam Study in 1964 indicated disapproval of abortion in response to a question which did not specify any circumstances (Hawley and Prachuabmoh, 1971b). In a survey of the Bangkok suburb of Bangkhen in 1968, only 4 percent favored abortion if the women simply wanted no more children, although 92 percent favored it

TABLE 56 General Attitudes Toward the Use of Birth Control as Reported in Selected Surveys: Thailand

	Approve	Dis-approve	Depends	Don't Know	Total Percent	N
WRPS, 1975: Rural						
Married men	76	15		8	100	925
Married women	86	9		6	100	425
Total	79	13		8	100	1,350
NS, 1979: Ever-Married Women						
Rural	81	14	2	3	100	2,154
Urban	82	12	4	2	100	444
Total	81	14	2	3	100	2,598
AFPH, 1979: Currently Married Women						
Rural	85	8	4	3	100	2,240
Urban	88	6	5	2	100	747
Total	86	7	4	3	100	2,987
CPS2, 1981: Ever-Married Women						
Own opinion	96[a]	2	1	1	100	7,038
Perception of husband's view	87	5	0	8	100	7,038

[a]Includes all women currently using contraception.

Sources: Deemar Company, Ltd. (1975); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

under circumstances where the birth endangered the life of the mother (Cowgill et al., 1969). In a national rural sample interviewed in 1972, only 19 percent of married women indicated approval of abortion if the couple did not want or could not afford another child (Burnight and Leoprapai, 1975). The most recent figures of a national sample come from NS and indicate very low percentages of ever-married women approving abortion as a means of avoiding a birth under normal circumstances. For example, only 6 percent of either urban or rural women indicated approval under conditions of contraceptive failure. However, a large majority indicated approval under special circumstances such as danger to the mother's health and rape (Institute of Population Studies, 1981).

The lack of public approval of abortion, as indicated by opinion survey evidence, seems to be inconsistent with indications that the practice of abortion is rather widespread. As Riley (1972:227) points out, while inducing abortion is theoretically considered a moral wrong, it is also recognized as a practice that might be carried out by a reasonable person under certain circumstances. The opinion surveys also show clearly that approval of abortion is highly dependent on the severity of the circumstances described in the question (see review of studies by Baker and Clinton, 1981). Quite likely the same set of circumstances when confronted in reality by the respondent herself may be perceived as considerably more severe and thus justifying abortion than when posited in the abstract in a survey question. Given the strong emphasis that individuals are responsible for their own fate in Thai culture, there may be considerably more social tolerance, if not approval, of abortion than indicted by the overwhelming disapproval expressed in response to opinion questions. Thus it is of interest that despite the widespread perception that abortion is being used with increasing frequency in Thailand as a birth control measure, neither the Buddhist hierarchy nor the government has spoken out strongly on this issue.[7] Apparently abortion is not the highly salient moral issue in Thailand that it is in some countries (Lauro, 1979).

NOTES

[1]Responses of currently married women, 15-44, whose present marriage is of less than five years duration are also less likely to be affected by rationalization, are

unlikely to be affected by selectivity and reflect very recent trends. Results based on LS1, NS, and CPS2 for these women show trends very similar to married women under 25:

	LS1 1969/1970	NS 1979	CPS2 1981
Rural	3.3	2.8	2.5
Urban	3.0	2.6	2.2
National	3.2	2.8	2.4

[2]Although Table 61 in Muangman (1979:15), which presents the relevant data, is labeled "Expected Number of Children," the text describing the findings suggests the question on which it is based referred to desired family size. In any event, for unmarried Thai adolescents, all of whom presumably have not yet started their reproductive careers, the distinction between expected and desired family size is probably unimportant.

[3]Rationalization of existing children might reduce the percent expressing a preference for no son or no daughter. However, NS national data on the preferred number of sons and daughters among currently married women aged 15-44 and married less than five years and among male household heads with wives aged 15-44 and married less than five years (groups presumably much less prone to rationalization) indicates similarly low percentages stating such a preference (provided they wanted at least one child):

	Percent Wanting No	
	Sons	Daughters
Women	1.8	3.5
Men	0.0	9.1

[4]For example, even if everyone had exactly the same preference for a particular combination of sons and daughters at the onset of their reproduction, if some of them later rationalized that they wanted the sex

composition that they attained, even though it was different from the one that they had initially wanted, this rationalization would lead to the appearance of heterogeneity in terms of preferences when in fact none existed initially.

[5]For couples who want at least one child of each sex and who have only children of one sex, having an additional child gives them a chance to meet the goal of having at least one child of each sex even if the resulting sex composition would be different from the one initially stated, given the necessity of going beyond the initial number of desired children. If the actual sex composition differs from the desired sex composition in any other way, it is not a simple matter to determine whether having an additional child could necessarily improve on the existing composition. Moreover, as McClelland (1979) points out, couples actually risk worsening the sex composition by having an additional child even when their actual sex composition is different from their desired composition.

[6]Although the wording of the questions was not identical, familiarity with the concept of family limitation or birth control was probably sufficiently widespread by the mid-1970s so that any reasonable wording directly asking about birth control or family planning would have been understood by the large majority of respondents and would have elicited a similar response.

[7]An attempt in 1981 to "liberalize" Thailand's restrictive abortion law was defeated in Parliament in 1981.

CHAPTER 8

THE PERVASIVENESS OF REPRODUCTIVE CHANGE DIFFERENTIALS BY EDUCATION, INCOME, AND RELIGION

Our examination of fertility trends, proximate variables, and family-size preferences clearly indicates that the current fertility transition taking place in Thailand is at least as much a rural as an urban phenomenon. Thus, reproductive change in Thailand appears to have permeated at least one very fundamental societal division. In this chapter, we explore further the pervasiveness of reproductive change by examining differentials in fertility, preferred numbers of children, and several proximate variables according to educational attainment, income, and religion. These social, economic, and cultural dimensions were chosen in part because of availability of information on them in a number of the fertility-related surveys. But more importantly, these variables represent basic characteristics that are generally assumed to affect a wide variety of social behavior and in particular are commonly expected to differentiate with respect to fertility-related attitudes and actions. Our goal in this chapter is primarily a descriptive one. We do not attempt to explain such differentials as they exist in Thailand except to a very limited extent within the proximate determinants framework. Rather, the main purpose is to determine how widespread the transformation of reproductive behavior and attitudes has become within the relatively brief time span of Thailand's fertility transition.

EDUCATIONAL DIFFERENTIALS

Besides place of residence, probably no other social variable has been as frequently associated with fertility differentials as education. It is generally

expected that at any given point in time, fertility and educational levels are inversely related and that during the fertility transition, better educated couples lead in the adoption of contraception and reduction of fertility. In addition, a common expectation is that improvements in the educational levels of the population in the course of socioeconomic development will contribute to declining fertility.

In Thailand, primary education comprises four years for the lower grades and three years for the upper grades. Relatively few women in the reproductive ages, especially in rural areas, have received more than a lower primary education, but at the same time there has been steady progress toward increasing proportions receiving a full four years of schooling. Until recently, four years of education was compulsory. The requirement has recently been extended to six years, but the extension is an ongoing process rather than a sudden universal change.

The implementation of this change, moreover, has not yet had much impact on the educational distribution of women in the reproductive ages in rural Thailand, the large majority of whom have attended school exactly four years. According to the 1960 census, only 4 percent of women 20-44 years of age had received more than four years of schooling. This increased to 8 percent by 1970 and to 11 percent by 1975. In 1970, 28 percent of women 20-44 had less than four years of schooling while fully 65 percent reported having exactly a fourth-grade education. The substantial increases over time in the proportion of women who received at least a fourth-grade education is evident in the comparisons of different age cohorts from the 1970 census. For example, the percentage of women who completed at least fourth grade was only 16 percent for women at all ages 45 and above, 54 percent for the 40-44 age group, and 88 percent for the 15-19 age group.

In analyzing data from the 1-percent sample of the 1960 census, Goldstein et al. (1972) found an inverse relationship between educational attainment and cumulative fertility in Thailand. The number of children ever born was lower for literate women in both rural and urban residence categories and a woman's educational attainment was inversely related to her fertility. Likewise, in analyzing the 2-percent sample from the 1970 census, Chamratrithirong and Boonpratuang (1977) found a substantial negative relationship of children ever born to educational attainment in all regions of Thailand and in both rural and urban places. A comparison of these two

studies suggests that educational differentials in completed fertility had increased between the two censuses.[1]

Table 57 presents several measures reflecting fertility and family-size preferences for currently married Thai women according to their educational attainment. Subdivision of the samples into educational categories reduces substantially the number of women on which each particular measure is based and thus increases the likelihood that the results will be affected by sampling error. This is particularly true for the highest educational category in the rural samples since so few rural women attended school past the basic four years of lower primary education. In addition, there are substantial differences in the distribution of educational attainment between the rural and urban sectors of the population, which should be kept in mind. Generally, substantially larger proportions of urban women fall in the highest educational attainment categories and substantially smaller proportions in the lowest. Given the recent trends toward increasing education, the age distributions within each educational attainment category differ considerably. In order to control for this, all results are standardized for age.

Results referring to children ever born are shown for LS1, NS, and CPS2. The same inverse relationship between cumulative fertility and education found in the census data referred to above is evident in the survey results. However, there is no sign of contraction in the differentials over time, although firm conclusions in this respect are not justified, given the problems with sample size. Educational differentials in the average number of living children are slightly less pronounced than for children ever born, especially for the rural sample, reflecting the higher child mortality experienced by women in the lower educational categories.

An inverse association between education and the expected number of children is apparent for all surveys shown. For the rural sample, the smallest differences are evident for the two earliest surveys. The most recent survey indicates that rural women with less than a fourth-grade education expected almost one child more than women with more than four years of schooling. The difference is even more pronounced for urban women. While also generally inverse for the preferred number of children, the relationship is considerably less pronounced. Data on the preferred number of children for

TABLE 57 Mean Number of Children Ever Born, Living Children, and Marital Fertility Index (I_g'), for Currently Married Women Aged 15-49; and Mean Number of Children Expected, Preferred for Self, and Preferred for Daughter, for Currently Married Women Aged 15-44, Standardized for Age, by Educational Attainment and Place of Residence: Thailand

	Place of Residence and Number of Years of Schooling					
	Rural			Urban		
	0-3	4	5+	0-3	4	5+
Children Ever Born						
LS1 1969/70	4.5	4.2	(3.5)	4.0	3.6	2.6
NS 1979	4.1	3.6	2.2	3.6	3.0	2.4
CPS2 1981	3.8	3.4	2.7	3.3	2.8	1.9
Living Children						
LS1 1969/70	3.7	3.6	(3.4)	3.7	3.3	2.5
NS 1979	3.6	3.2	2.1	3.5	2.8	2.3
CPS2 1981	3.3	3.1	2.5	3.1	2.6	1.9
Expected Number						
LS1 1969/70	4.6	4.4	(4.1)	4.4	4.0	3.7
LS2 1972/73	4.0	3.9	3.7	4.4	3.8	3.1
SOFT 1975	4.2	4.0	3.1	3.9	3.4	3.1
CPS1 1978/79[a]	3.9	3.6	3.3	3.5	3.2	2.7
NS 1979	4.1	3.8	2.8	4.0	3.4	2.7
AFPH 1979[b]	4.0	3.7	3.3	3.9	3.4	2.8
CPS2 1981	3.7	3.4	2.9	3.4	2.9	2.3
Preferred Number						
LS1 1969/70	4.1	3.8	(4.0)	3.8	3.7	3.2
LS2 1972/73	4.0	3.9	3.8	3.6	3.5	3.0
SOFT 1975	3.8	3.6	3.2	3.4	3.4	3.1
NS 1979	3.5	3.3	2.7	3.7	2.9	2.7
AFPH 1979[b]	3.3	3.2	2.9	2.9	3.0	2.7
CPS2 1981	3.2	3.0	2.5	3.0	2.6	2.3
Preferred Number for Daughter						
AFPH 1979[b]	2.9	2.8	2.7	2.8	2.8	2.6
I_g' (for 2 years prior to survey)[c]						
LS1 1969/70	.67	.69	(.50)	.52	.50	.39
LS2 1972/73	.62	.58	(.58)	.53	.45	.44
SOFT 1975	.56	.54	.45	.47	.43	(.51)
NS 1979	.48	.39	(.38)	(.31)	.43	(.46)
I_g' (for years prior to survey)						
CPS2 1981	.47	.46	.49	.47	.45	.49

TABLE 57 (continued)

Notes: Expected number of children equals the number of living children plus the additional children desired. The age distribution of currently married women in the whole country as reported in the 1970 census was used as the basis for the age standardization. Results for children ever born and living children in parentheses are based on fewer than 50 cases; I_g' results shown in parentheses are based on an average of fewer than 50 woman years of observation per five-year group.

[a]Urban sample refers to Bangkok metropolitan area.
[b]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.
[c]Not directly comparable to I_g' results in Tables 5 or 6 that are based on births during one year prior to the survey.

Sources: Knodel et al. (1980); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

daughters collected in the AFPH survey show almost no association between family-size preference and education, suggesting that in the absence of rationalization, the association between education and preferred number for self might be even weaker, although it should be noted that even preferred number for self shows a particularly weak relationship in the AFPH results.

Current marital fertility as measured by I_g' is also inversely related to education for rural women in most surveys, but almost no relationship is evident in results from CPS2, the most recent survey. Less consistency in terms of an inverse relationship is indicated for urban women, and again the CPS2 results suggest little association with education. Moreover, preliminary results from NES, a large survey of northeastern women, indicate almost no educational differential in current marital fertility, with I_g' for 1979 equaling .46, .48, and .47 for women in the three successive educational categories.

Perhaps the most important picture emerging from the results on educational differentials is that the recent transformation in reproductive behavior and family-size preferences in Thailand is occurring in all educational categories. Less-educated women have participated in the changes in the last decade at least as much as better educated women.

Educational differentials are available for several of the principal proximate variables. Table 58 presents selected measures of nuptiality by educational attainment based on the 2-percent sample of the 1970 census, while Figure 8 shows the percentage single by age for men and women at different educational levels.

TABLE 58 Selected Measures of Nuptiality by Educational Attainment, 1970: Thailand

Nuptiality Measure	No Schooling	Primary	Secondary	University
Singulate Mean Age at Marriage				
Men	24.5	24.3	26.7	29.5
Women	20.2	21.7	25.4	29.2
Percent Single 40-44				
Men	5.4	2.2	5.4	3.6
Women	3.9	3.5	11.1	31.7
Marital Status Indexes				
I_m (married)	.770	.646	.317	.291
I_s (single)	.148	.305	.661	.689
I_d (divorced)	.016	.011	.004	.002
I_p (separated)	.021	.020	.013	.014
I_w (widowed)	.044	.018	.004	.004

Note: Primary refers to grades 1-7, secondary to grades 8-12.

Source: Adapted from Chamratrithirong (1980).

In most populations, higher educational attainment is associated with later ages at marriage, and Thailand is no exception in this respect (see, e.g., Durch, 1980). For both men and women, the differences in the singulate mean age at marriage are small between those with no schooling and those with primary schooling, but higher levels of education are associated with considerably later ages at marriage. The impact is greater for women than for men. Permanent nonmarriage as measured by the percent single at ages 40-44 show little association with education for men but show a marked increase with greater education for women for levels past primary schooling. As Figure 8 shows, educational differentials in the percent single at all ages are more pronounced for women than for men, and a considerable proportion of women with secondary and particularly with university education never marry.

These same differences are reflected in the marital status indexes I_m and I_s and suggest that nuptiality differences by educational categories can have very substantial impacts on educational differences in cumulative fertility. There is, of course, no guarantee

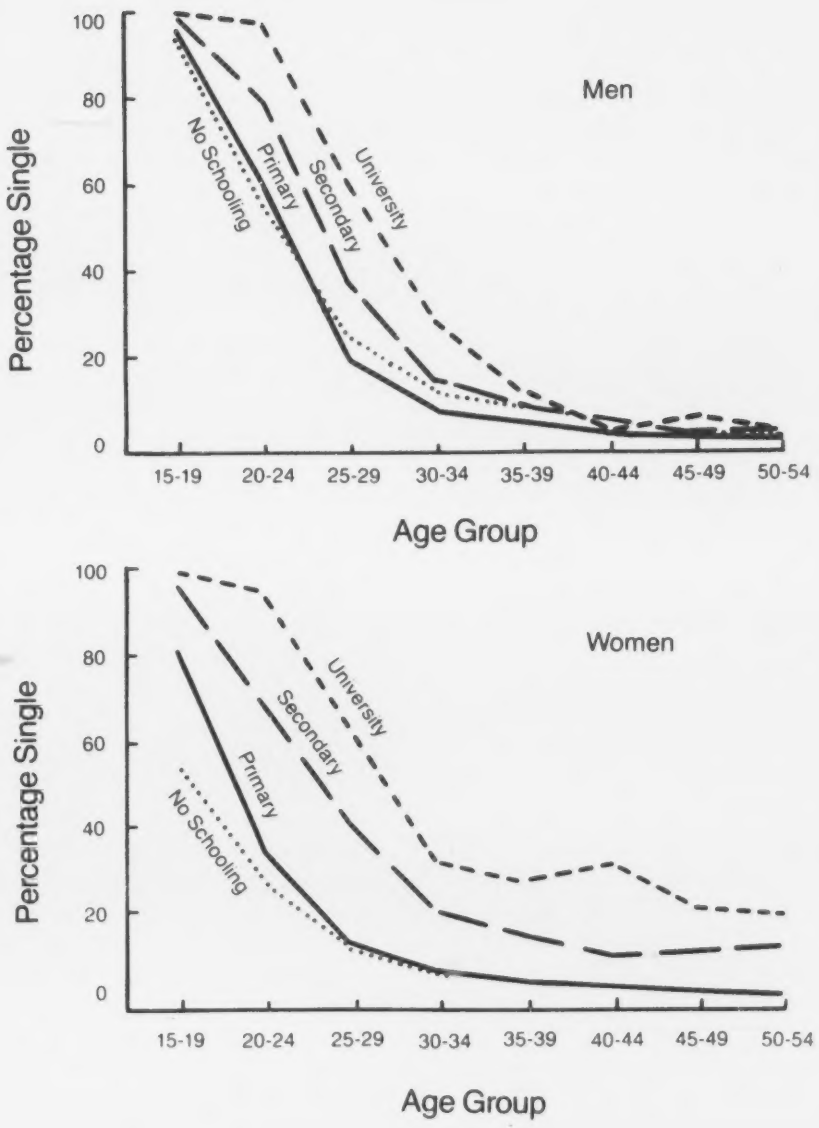


FIGURE 8 Percentage of Men and Women Single by Age, for Four Educational Levels, 1970: Thailand

Source: Chamratrithirong (1980).

that these differentials will persist, particularly as the educational composition of the Thai population changes. It is worth noting, however, that the changes in educational composition of women in reproductive ages could have had only limited impact on the overall nuptiality pattern since only modest increases have occurred in any absolute sense in the percentage of women going beyond primary school, the point at which the impact on marriage seems to make a substantial difference.

The marital status indexes point to a distinct inverse association between education and marital dissolution. This relationship would tend to counterbalance the positive association between age at marriage and education in terms of consequences for educational differentials in cumulative fertility among ever-married women. Educational differences in the proportion of women widowed reflect differences in mortality associated with socioeconomic status. Lower proportions of divorced or separated among the better educated may have several explanations, as Chamratrithirong (1980) has discussed. Since the age at marriage is higher among the better educated, such women are exposed to a shorter period of risk of divorce or separation. In addition, women of higher socioeconomic status may tend to remarry more than women of lower socioeconomic status. Marital stability could be related to financial stability, which presumably could be greater among the better educated. Since the three marital status indexes referring to the different types of marital dissolution are low in an absolute sense regardless of educational attainment, differentials and marital disruption are unlikely to account for much of the educational differentials in fertility.

Analysis of data from SOFT also points to a clear inverse relationship between marital dissolution and education. Based on life table analysis, the probability of first marriages being dissolved within ten years based on the experience of women aged 25-49 is 21 percent for those with no education, 13 percent for women with primary education, and 10 percent for those with middle education (Smith, 1981). Since this analysis explicitly takes marriage duration into account, the differences cannot be a result of differences in the period of exposure. However, widowhood is included as one source of dissolution, so the results might reflect in part differential mortality risks by education.

Data on the relationship of breastfeeding with the mother's number of years of schooling are shown in

Table 59. The measure of breastfeeding is the percent of mothers still breastfeeding their most recent child at the time of the survey among women who had a birth within three years prior to the survey. In several of the data sets, information on current breastfeeding status was available only for nonpregnant women. The results indicate that breastfeeding has been declining among all educational groups with the possible exception of better educated urban women, who were already characterized by very low levels of breastfeeding in the earliest survey. For all surveys, the highest educational group was characterized by distinctly lower proportions still breastfeeding than the other two groups. For several surveys, the most highly educated rural women were characterized by even lower proportions still breastfeeding than their less educated urban counterparts, although it should be stressed that even by 1979 only a very small fraction of rural women in reproductive ages belonged to the highest educational category. To the extent that decreased breastfeeding influences educational differentials in fertility (through ending postpartum infecundability), it operates in a direction opposite to the one that has generally prevailed. All else being equal, the shorter breastfeeding of the better educated should lead to higher rather than lower fertility. Obviously educational differences in other proximate determinants must outweigh the influence of decreased breastfeeding.

Educational differentials in the percent of married women who are currently practicing and who ever practiced contraception are shown in Table 60. Most surveys show a direct relationship between contraceptive prevalence and years of schooling in both rural and urban sectors of the population. Undoubtedly the educational differentials in marital fertility observed in many of the surveys reviewed is largely a result of these differentials in contraceptive use. While the results are not completely consistent in this respect, they generally point to a contraction in the educational differentials in the percent currently practicing over the period spanned by the surveys.

Clearly, the rapid increase in contraceptive prevalence has occurred among all educational groupings of the population and indeed has been, if anything, more rapid among the least educated women. While lesser educated women may have lagged behind briefly during the initial stages of the spread of contraception, the evidence suggests that a catch-up effect has already taken place. The experience of Thailand in comparison with the

TABLE 59 Percent Still Breastfeeding Most Recent Child Among Women with a Birth in the Three Years Prior to Interview, by Educational Attainment and Residence, Standardized for Number of Years Since Last Birth: Thailand

	Education of Women (years)		
	0-3	4	5+
Nonpregnant Women			
Rural			
LS1 1969	74.3	77.8	--
LS2 1972	75.0	72.3	(38.9)
SOFT 1975	70.8	67.6	49.5
NS 1979	59.9	57.4	(14.3)
Urban			
LS1 1970	48.1	47.2	22.1
LS2 1973	41.0	37.9	16.5
SOFT 1975	(36.9)	36.2	14.0
NS 1979	--	(29.0)	(22.6)
All Women			
Rural			
SOFT 1975	66.9	63.6	46.2
NS 1979	57.3	55.9	(14.3)
Urban			
LS2 1973	36.6	34.7	15.6
SOFT 1975	(31.9)	32.1	13.6
NS 1979	--	30.5	(22.1)

Notes: Standardization performed by applying equal weights procedure to results by successive categories of one-year duration each. Results based on 20 to 49 cases are shown in parentheses; results based on fewer than 20 cases are not shown.

Source: Adapted from Knodel and Debavalya (1980).

TABLE 60 Percent Currently Practicing and Percent Ever Practiced Contraception for Currently Married Women Aged 15-44, Standardized for Age, by Educational Attainment and Place of Residence: Thailand

Contraceptive Use and Survey Source	Place of Residence and Number of Years of Schooling					
	Rural			Urban		
	0-3	4	5+	0-3	4	5+
Percent Currently Practicing						
LS1 1969/70	7	13	(17)	28	31	36
LS2 1972/73	13	26	38	34	42	54
SOFT 1975	33	36	45	44	50	53
CPS1 1978/79[a]	50	52	52	59	65	65
NS 1979	48	48	57	42	50	64
AFPH 1979[b]	43	48	47	60	58	64
CPS2 1981	52	58	61	64	63	66
Percent Ever Practiced						
LS1 1969/70	9	18	(20)	33	38	46
LS2 1972/73	20	33	(48)	51	53	65
SOFT 1975	43	51	67	66	62	73
CPS1 1978/79[a]	67	71	77	83	87	86
NS 1979	55	64	71	77	70	81
AFPH 1979[b]	62	66	83	78	76	80
CPS2 1981	74	78	83	80	83	89

Notes: The age distribution of currently married women for the whole country as reported in the 1970 census was used as the basis of age standardization. Results in parentheses are based on fewer than 50 cases.

[a]Urban sample refers to Bangkok metropolitan area.
[b]Results refer to a universe of 20 provinces; the urban sample refers to provincial urban only.

Sources: Knodel et al. (1980); Kamnuansilpa and Chamratrithirong (1982); and unpublished tabulations.

historical record of Western countries points not only to a much accelerated pace of fertility transition but probably also to more pervasive participation during the early stages, at least with respect to educational groupings.

FAMILY INCOME

Determining family income is considerably more difficult than determining educational attainment. The concept of family income is far more complex and the subject matter more sensitive. Nevertheless, attempts were made in several of the surveys to collect information on recent family income, thus making it possible to examine differentials in reproductive behavior and attitudes along this dimension. The difficulties inherent in measuring income give reasons to be cautious in interpreting the results, especially since in most cases information on income was based on responses to a simple direct question. Moreover, current income is not necessarily an accurate reflection of a family's wealth. In interpreting results, one must keep in mind the reasonably rapid inflation in Thailand over the last decade; the same absolute family income at the beginning of the 1970s was worth considerably less by the end.

In the Longitudinal Study, information on family income was collected only for the rural phase of the second round. Table 61 shows a variety of measures of reproductive behavior and fertility desires for five income categories. Income is expressed in terms of the Thai baht (there were approximately 20 baht to one U.S. dollar during the 1970s). The sample was distributed more or less equally across the five income categories shown.

The results suggest only weak differences in cumulative fertility as measured by children ever born according to family income. Although the largest mean number of children ever born characterized the lowest income group, there is not a consistent inverse relationship among the remaining categories. Apparently, infant and child mortality is higher for the lower income group and thus in terms of the mean number of living children, they are not distinctly higher than several other income groups. Differentials in the expected number of children are even weaker than for cumulative fertility, with almost no differences evident across the income categories. A

TABLE 61 Selected Fertility-Related Variables by Family Income, Standardized by Age Among Rural Women with a Child Under Three Years Old, 1972: Thailand

Fertility-Related Variables	Annual Family Income (in baht)				
	Under 1,000	1,000-1,999	2,000-3,999	4,000-9,999	10,000 and over
Children ever born	4.4	3.8	3.8	4.1	4.0
Living children	3.7	3.3	3.3	3.7	3.6
Expected number	4.2	3.9	3.9	4.0	3.8
Percent pregnant	17	16	19	8	8
Months since last birth[a]	27	29	35	36	40
Percent current use of contraception	9	20	24	36	40
Percent ever use of contraception	14	27	27	43	43
Percent wanting no more children	61	54	56	65	60
Preferred number of children	4.1	3.9	4.0	4.0	3.6
Percent still breastfeeding last born child under 3[b]	79	78	78	68	56

Note: The age distribution of currently married women for the whole country as reported in the 1970 census served as the basis for the age standardization.

[a]Excluding currently pregnant women.
[b]Standardized for number of years since last birth by applying equal weights procedure to results tabulated by successive categories of one-year duration.

Source: LS2.

somewhat different picture is suggested for current fertility, as indicated by either the percent pregnant or the average open interval measured in terms of months since last birth. Percent of women pregnant among the two highest income categories is distinctly lower than for the other three, and a consistent inverse association is indicated between income and open interval. There appears to be a more or less inverse association between income and breastfeeding, again with the two highest income categories showing distinctly lower percentages still breastfeeding their last child under age three (after standardization for age of child). Whatever fertility-enhancement effect the lower breastfeeding might have is apparently more than compensated for by the rather sharp differentials in current use of contraception. A distinctly positive relationship is evident between income and percent of women currently practicing contraception; women in the highest income category are more than four times as likely to be practicing contraception as those in the lowest. Differentials in the percent who ever used contraception are less consistent but nevertheless generally in the same direction.

Finally, the two measures of fertility desires, the percent wanting no more children and the mean preferred number of children, show only weak differences across income categories.

One exception to studies that obtained information on family income through a simple direct question was SOFT, in which a more complex approach was taken. Family income was calculated as the sum of a variety of separate components, including farm income, which in turn was estimated indirectly from farm size, crops grown, and animals raised. In a study of economic factors in family-size decisions in Thailand, Arnold and Pejaranonda (1977) classified couples according to this measure of family income, dividing them into five roughly equal categories. Their study presents results of a multiple classification analysis which relates the preferred number of children as expressed by husbands and the percent of fecund women currently using contraception to family income as well as a variety of other variables. The differentials in preferred number of children and contraceptive prevalence according to family income are summarized in Table 62. Prior to adjustment for other socioeconomic variables, the preferred number of children among married men showed an inverse relationship with family income while contraceptive prevalence among fecund women showed a distinct

TABLE 62 Mean Preferred Number of Children Among Married Men with Wives Under Age 50 and Percent of Fecund Married Women Currently Using Contraception by Family Income, Unadjusted and Adjusted by Multiple Classification Analysis for Selected Socioeconomic Variables, 1975: Thailand

	Preferred Number of Children for Married Men		Percent of Fecund Women Currently Using Contraception	
Family Income	Unadjusted	Adjusted	Unadjusted	Adjusted
Level 1 (lowest)	4.4	4.2	29.8	33.5
Level 2	4.4	4.2	36.3	38.7
Level 3	4.0	3.9	41.9	42.0
Level 4	3.7	3.7	45.7	43.2
Level 5 (highest)	3.5	3.7	46.1	42.2

Notes: Preferred number of children adjusted for husband's and wife's education, place of residence, husband's occupation, wife's employment status, number of living children, and indexes of perceived cost and utility of children. Contraceptive use adjusted for all the above plus wife's age.

Source: Adapted from Arnold and Pejaranonda (1977).

positive relationship, similar to the LS2 findings. Adjustment for a whole variety of socioeconomic variables reduces the differential somewhat, but the associations persist nevertheless.

The two most recent surveys that permit examination of differentials by family income are AFPH and NES, the latter referring to a large sample of rural northeastern women. In addition to inquiring about income, AFPH included a question concerning the respondents' perception of their wealth relative to others which permits us to classify respondents according to their perceived relative wealth as well as to their reported annual income. The AFPH results also permit a comparison of income differentials for the rural and urban populations (although urban is limited to provincial towns).

The AFPH results, presented in Table 63, reveal a general inverse relationship between income and total expected number of children in the rural portion of the sample, but a much less regular relationship is apparent for the urban portion. When classified by perceived relative wealth, the inverse relationship for the rural sample more or less disappears while a distinct inverse relationship emerges for the urban sample. It should be kept in mind that there is greater variation in income among the urban population and this is probably reflected in sharper perceptions of differences in relative wealth. Current fertility as reflected in the percent pregnant shows an irregular relationship with annual family income in both the rural and urban samples. However, a positive relationship with perceived relative wealth is indicated for the rural sample while a distinctly negative one is indicated for the urban sample. The positive relationship between current contraceptive use and annual income observed in the earlier surveys is also evident in the AFPH results, although the differentials appear less pronounced and are rather irregular for the urban sample. With regard to perceived relative wealth, there is virtually no relationship with the percent currently using contraceptives for the rural sample, although a direct relationship is evident for the urban sample. Curiously, an association of ever use with relative wealth is virtually absent for the urban sample. Inverse relationships between the preferred number of children for self and both annual family income and perceived relative wealth are evident, although the differences are not large. These differences contract considerably for the rural sample and virtually disappear for the urban sample when the preferred number for a daughter is considered.

TABLE 63 Selected Fertility-Related Variables, by Family Income, Perceived Relative Wealth, and Place of Residence, Standardized for Age, Currently Married Women Aged 15-44, 1979: Thailand

	Total Expected Children		Percent Pregnant		Percent Current Use Contraception		Percent Ever Use Contraception		Preferred Number of Children			
									For Self		For Daughter	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Annual Family Income (in baht)												
Under 5,000	3.97	3.37	11.2	12.0	43.3	50.1	62.2	70.0	3.42	3.15	3.00	2.7
5,000 - 9,000	3.98		11.1		43.7		58.6		3.32		2.90	
10,000 - 14,000	3.80	3.83	8.6	6.2	48.7	41.1	69.3	61.6	3.16	2.95	2.83	2.7
15,000 - 24,000	3.55	3.37	10.0	7.2	47.2	64.6	66.2	80.7	3.16	2.94	2.77	2.6
25,000 - 34,000	3.74	3.43	10.0	10.4	48.1	61.9	64.1	83.4	3.14	2.86	2.71	2.8
35,000+	3.45	3.18	6.8	8.4	55.1	61.3	75.8	78.1	2.96	2.89	2.78	2.7
Perceived Relative Wealth												
Poorer	3.83	3.57	10.3	7.2	46.5	56.8	65.5	74.5	3.28	2.96	2.85	2.6
Average	3.71	3.26	9.8	9.5	47.4	60.3	65.2	77.8	3.19	2.95	2.84	2.7
Wealthier	3.73	3.10	9.2	13.2	49.6	64.0	71.1	75.3	3.10	2.72	2.71	2.6

Note: The age distribution of currently married women for the whole country as reported in the 1970 census was used as the basis of the age standardization.

Source: AFPH.

Results for the NES, presented in Table 64, are striking with respect to the weak differences apparent across income categories for most of the variables. The sharpest differentials seem to be the inverse association between current marital fertility as measured by I_g' and income. No similar inverse relationship is apparent for the percent currently pregnant, although this is undoubtedly an inferior measure of current fertility. Differences in cumulative fertility as measured by children ever born are minimal as are differences in the preferred number of children and the percent wanting no more children. Indeed, the data on fertility desires are remarkable in showing virtually no difference at all across income groups. While there is some evidence of a direct association between contraceptive use and family income, the differentials are very small and contraceptive use rates are rather high even for the lowest income group.

The data on differentials in reproductive behavior and attitudes by income for the four surveys reviewed suggest that income differentials are less marked than educational differentials. The most consistent pattern found was a direct association between contraceptive use and income, although the evidence from the two most recent surveys and particularly the NES suggest that these differences have contracted considerably. Given problems with measuring income as well as comparability in income categories among the different surveys, these findings can only be considered suggestive. Moreover, the NES results refer only to the northeast. Some confirmation is provided by a recent survey conducted in eight rural districts in the northeast, which also found a noticeably weak association between contraceptive use and income class (Grandstaff, 1980). Perhaps most importantly, the data are fairly clear in indicating that all income categories have participated substantially in the reproductive changes that have occurred over the last decade. Hence, both with respect to education and income, Thailand's fertility transition can be considered quite pervasive.

RELIGION

Over 90 percent of the Thai population is considered Buddhist and 5 percent adhere to Islam, the second largest religion. Nevertheless, religious differentials in fertility and related behavior are of interest because

TABLE 64 Selected Fertility-Related Variables by Family Income, Currently Married Women Aged 15-44, Standardized for Age, Rural Northeast, 1980: Thailand

Fertility-Related Variables	Annual Family Income (in baht)					
	Under 4,500	4,500-9,499	9,500-14,499	14,500-24,499	24,500 34,499	34,500 and over
Children ever born[a]	3.7	3.7	3.7	3.8	3.7	3.5
I_g (for 1979)	.55	.47	.45	.43	.43	.40
Percent currently pregnant	9.9	9.0	11.4	9.4	9.0	9.5
Percent current use of contraception	48	49	50	56	52	55
Percent ever use of contraception	59	59	61	67	64	65
Percent wanting no more children	55	56	57	57	57	55
Preferred number of children	3.5	3.4	3.4	3.4	3.4	3.9

Note: The age distribution of ever-married or currently married women, as appropriate, for the whole country as reported in the 1970 census was used as the basis for the age standardization.

[a]Including stillbirths.
[b]Excluding preference for no children due to coding problems in data set.

Source: NES.

cultural differences between Buddhists and Moslems are relatively sharp within the generally homogeneous Thai society. Information on religious reproductive differentials is limited because of the low proportion of Moslems in the population and the consequent small numbers that are included in any national sample survey. Moreover, the Longitudinal Study (LS1 and LS2) purposely excluded the four heavily Moslem provinces in the south and the two Contraceptive Prevalence Surveys (CPS1 and CPS2) do not include information on the respondent's religion, thus effectively precluding analysis of religious differentials from these surveys. Nevertheless, the limited data available from SOFT and from other specialized surveys suggest that Moslems have participated considerably less in the recent reproductive changes that have taken place and represent probably at least one exception to the pervasiveness that otherwise characterizes Thailand's fertility transition.[2] As a result, the somewhat complex pattern of religious differentials in fertility that existed formerly appears to have changed considerably in a relatively brief period of time.

In one of the earlier studies of religious differentials in fertility in Thailand, Goldstein (1970) analyzed the 1-percent sample tabulation of the 1960 census and found substantial differentials between Buddhists and Moslems, with the latter characterized by distinctly lower numbers of children ever born. This finding held for each of the broad age groups analyzed but was considerably more pronounced at older ages. Given that Moslems marry at a considerably earlier age than Buddhists, the lower cumulative fertility is particularly interesting. Goldstein speculated that more frequent divorce and remarriage may account for the lower Moslem fertility rates. He also suggested that poor health may play a part.

Data from the 1970 Rural Employment Survey in southern Thailand, which included questions on fertility and contraception, also indicated that Moslem women had a substantially lower average number of children ever born than Buddhist women by the end of the reproductive span. At younger ages, however, the average number of children ever born was higher for Moslem women, with the crossover in differentials occurring around age 35 (Jones and Soonthornthum, 1971). Information on contraceptive use indicated that prevalence was low for both groups. The authors concurred with Goldstein's view that one possible

source of the religious differentials in completed fertility at older ages was probably higher rates of divorce and separation among Moslems. Unfortunately, their data set lacked adequate information to explore this hypothesis.

Although the number of Moslems included in SOFT was not large, the sample did include several districts in the heavily Moslem provinces of the south and thus there are sufficient cases available to permit at least a suggestive analysis of religious differentials in fertility and to reveal proximate determinants. Data on cumulative fertility and marriage patterns based on SOFT are summarized in Table 65. Since well over two thirds of the Moslem women interviewed were from the southern region, comparisons between Buddhists and Moslems at the national level can be distorted by regional differences. Therefore, results are shown separately for the southern region, enabling comparisons between southern Buddhists and Moslems. The findings on children ever born are consistent with those based on the special 1970 KAP survey, indicating somewhat higher cumulative fertility for Moslem women under age 30 but lower numbers of children ever born for older Moslem women compared to Buddhists. The higher Moslem fertility at younger ages is not surprising in light of the substantially earlier age at first marriage among Moslems. The religious differentials in age at first marriage are even more pronounced when the comparison is limited to the southern region. Although these data on age at first marriage are affected by a truncation bias (as discussed in Chapter 3), and since this bias affects both religious groups, it is unlikely to bias the comparisons very much. While Moslem women marry at an earlier age, they also experience considerably more divorce or separation, as indicated both by the higher percent who are currently divorced or separated and the higher percent who are currently married but who have had more than one husband. Again, these religious differentials are even more pronounced when comparison is limited to the southern region. The higher prevalence of marital dissolution among Moslem women acts in a contrary direction to the younger age at marriage as an influence on cumulative fertility and is a potential explanation for the lower numbers of children ever born found for Moslem women at the older reproductive ages.

Smith's (1981) application of life table techniques to data from SOFT in order to estimate marital dissolution

TABLE 65 Mean Number of Children Ever Born, Mean Age at First Marriage, Percent Currently Divorced or Separated, and Percent Married More than Once, by Religion and Age, Ever-Married Women, 1975: Thailand

Geographical Area and Age Group	Children Ever Born		Age at First Marriage		Percent Divorced or Separated		Percent Married More than Once	
	Buddhist	Moslem	Buddhist	Moslem	Buddhist	Moslem	Buddhist	Moslem
National								
Under 30	1.90	2.41	18.9	16.7	4.6	8.0	5.5	12.1
30-39	4.42	4.25	20.3	17.1	4.6	2.3	13.5	40.8
40+	6.41	5.88	20.2	17.9	4.7	11.7	16.6	41.0
All ages	3.93	3.73	19.7	17.1	4.6	7.8	11.1	25.9
Southern Region								
Under 30	2.15	2.32	19.1	15.9	2.8	11.3	2.5	17.1
30-39	4.54	4.16	21.0	16.2	2.1	2.8	11.0	49.4
40+	6.53	5.74	20.7	17.1	4.0	13.4	19.7	51.6
All ages	4.29	3.66	20.2	16.3	2.9	9.9	10.6	33.8

Source: SOFT.

rates also indicates greater dissolution among Moslems. His analysis controls for educational differentials among the two religious groups by limiting the comparison to women with no more than a primary education. His estimates indicate that 14 percent of first marriages for Buddhists and 32 percent for Moslems dissolve within the first ten years.

Additional evidence on differences in nuptiality patterns by religion are available from an analysis of the 2-percent sample of the 1970 census by Chamratrithirong (1980). His results indicate a singulate mean age at marriage for Moslem women of 19.6 compared to 22 for Buddhist women. Moreover, the percent never married among women aged 40-44 was also lower for Moslem women: no less than 1 percent compared to 4 percent for Buddhists of the same age.

There is some evidence to suggest that a shift may have occurred in Buddhist-Moslem fertility differentials in the course of Thailand's recent fertility transition. Based on a survey conducted in 1980, a study of religious fertility differences in the Jana district of Songkla province in southern Thailand found higher average numbers of children ever born among Moslem women, not only at most younger ages but also at older ages (Porapakkham and Serikajornkitjarean, 1981). Moreover, this study found distinctly lower current marital fertility for Buddhist compared to Moslem women: the I_g' was .35 for Buddhist women and .50 for Moslem women based on births in the year prior to the survey. Measures of current marital fertility by religion are not available for previous studies, but data from SOFT indicate that within the southern region there was no difference in the self-reported rate of pregnancy in 1975; 12 percent of both southern Buddhist and southern Moslem women reported themselves as pregnant at the time of the interview.

There are, of course, problems of comparability between a survey which is based on only one district and other surveys which have drawn from broader populations but are based on small numbers of cases. For example, an I_g' of .42 for both religious groups combined for the Jana district is noticeably lower than the rate for the southern region based on any of the surveys, including CPS2 which took place a year later (see Table 6). Sampling fluctuations and differences in methodology are also potential sources of discrepancies when making comparisons. However, information on religious differentials in contraceptive prevalence found in several surveys over

the last decade and summarized in Table 66 indicates that a substantial gap in contraceptive practice has developed between Buddhists and Moslems.

This gap is of considerable importance given the leading role of contraceptive use among the proximate determinants responsible for Thailand's fertility decline (see Chapter 6). At the start of the 1970s, contraception was practiced by relatively few rural women in the south regardless of religion. While Buddhist couples in the south may lag somewhat behind couples in other

TABLE 66 Percent Currently Practicing Contraception Among Currently Married Women, by Religion, from Selected Surveys: Thailand

Survey and Geographical Area	Buddhist	Moslem
Rural Employment Survey, 1970		
Southern region	9.4	4.2
SOFT, 1975		
All Thailand	41.1	11.9
Southern region	25.8	7.2
Thai Moslem Fertility Survey, 1976		
Five southernmost provinces	--	13.6
Jana District Survey, 1980		
Jana District in southern Thailand		
All methods	46.7	23.0
Excluding withdrawal	31.7	9.0

Notes: Results from SOFT refer to currently married women under age 45; all other results refer to currently married women under age 50. Results from the Rural Employment Survey are reported by the husband and refer to nonpregnant women only. Results for the Thai Moslem Fertility Survey are the average of those reported by wives and husbands.

Sources: Jones and Soonthornthum (1971); Thailand, National Economic and Social Development Board (1978); Porapakkham and Serikajornkitjarean (1981); and unpublished tabulations.

regions in the adoption of family planning, as indicated by results from SOFT, contraceptive practice among them still increased considerably and apparently to a considerably greater extent that for Moslem women. The 1980 results for the Jana district indicate that Moslem women are not only much less likely to be practicing contraception but that a larger share of those who do so report using some nonmodern method, particularly withdrawal, rather than the modern methods practiced by the Buddhists. Examination of the methods reported in SOFT help confirm this finding: close to half of the small number of Moslem users reported some nonmodern method compared to only a very small proportion of all users. While direct evidence on effectiveness of different methods in Thailand is not available, experience from other countries suggests that nonmodern methods such as withdrawal are probably less effective that most modern methods.

Given the low proporation of Moslem women practicing contraception and particularly modern methods, we must look to other proximate determinants as explanatory factors underlying their relatively low fertility in the past. Clearly, marriage patterns and in particular high rates of marital dissolution have played a part. Data from SOFT suggest that religious differentials in breastfeeding patterns may also be of some importance. Table 67 summarizes data on a variety of breastfeeding indexes by religion. While Buddhist and Moslem women resemble each other on a national level, the southern region Moslem women clearly breastfeed their children longer than Buddhist women do. If such differences have been true in the past, this could help account for the lower cumulative fertility characterizing older Moslem women that has been found in a number of studies.

Given the relatively scanty information that is currently available on religious differentials in reproductive behavior, firm conclusions on the extent of the differentials and the proximate determinants underlying them would be premature. However, the results suggest that important differences in proximate determinants do underlie the observed religious fertility differentials. Moreover, it is likely that both the extent and nature of the religious differentials in fertility as well as in the proximate determinants may be changing as Thailand's fertility transition proceeds. The data suggest for example, that religious differentials in contraceptive use may actually be increasing and thus, unlike educational or family income differentials, religious differ-

TABLE 67 Selected Indexes of Breastfeeding by Religion: Thailand

Selected Indexes	National		Southern Region	
	Buddhist	Moslem	Buddhist	Moslem
Estimated Mean Age at Weaning From Percent Still Breastfeeding[a]	18.8	19.0	18.8	22.0
Reported Mean Age at Weaning of Next-to-Last-Born Child	17.2	18.9	17.1	22.0
Percent Reporting Breastfeeding Last-Born Child More than 3 Months[b]	85	80	81	87
Percent Reporting Breastfeeding Last-Born Child More than 12 Months[c]	70	71	59	83
Adjusted Percent Still Breastfeeding Last-Born Child Under 3 Years of Age[d]	63	62	64	75

[a]For technique of calculation, see Knodel and Debavalya (1980).
[b]Women whose last-born child was less than 3 months old and was still being breastfed were assumed to breastfeed for at least 3 months.
[c]Based on women whose last birth occurred at least 12 months ago.
[d]Adjusted for number of years since most recent birth by Multiple Classification Analysis (MCA). Women who reported a duration of breastfeeding longer than the open birth interval were coded as still breastfeeding, even though they were not directly reported as such.

Source: SOFT.

entials may become more rather than less prominent in the future.

In short, there seems to be clear evidence that reproductive change has been quite pervasive in Thailand in terms of at least two fundamental social and economic dimensions--education and income. The same is not true, however, in terms of a basic cultural dimension, as represented by religion. The overall demographic impact of the lack of full participation of Moslems in the process of fertility transition is minimal given their small share of the total population. The implications for an understanding of this process, however, may be considerably greater. A search for explanations of the decline of Thai fertility beyond the proximate determinants framework would undoubtedly profit from a fuller understanding of the contrasting paths taken so far by Buddhists and Moslems.

NOTES

[1]In each study, women were classified into four educational categories: no schooling, primary education, secondary education, and university education. The categories of primary and secondary education are not the same. In the 1960 study, primary education included women with 1-4 years of schooling; in 1970, primary education included women with 1-7 years of schooling with complementary differences reflected in the secondary education category. Nevertheless, the results seem to point clearly to an increasing differential by educational attainment. For example, the mean number of children ever born to ever-married women aged 20-44 standardized for age using the 1970 age distribution for all women as the standard, shows the following differentials: If the number of children ever born to women with no schooling is indexed as 100, those with primary, secondary, and university education are, respectively, 99, 82, and 60 in 1960; and 95, 58, and 44 in 1970.

[2]Sharp differentials may also characterize other ethnic minorities, but their small numbers and exclusion from survey coverage generally prevent analysis. Hill tribes in particular may be characterized by considerably higher fertility at present than most of the Thai population, but relatively little reliable information is available for them. Moreover, they are less integrated into the mainstream of Thai society and polity than are the Moslems.

CHAPTER 9

SUMMARY AND CONCLUSIONS

Thailand is among a growing number of developing countries that have moved in recent years from an early stage of demographic transition characterized by falling mortality in the presence of high, relatively stable fertility to a later stage in which fertility has also started to decline. In Thailand this progression has been both recent and rapid. Although reliable statistics on mortality and fertility for earlier periods are lacking, the evidence available suggests that mortality has been declining since the early decades of this century with a probable interruption associated with the events of the Second World War. It is also difficult to date the onset of the fall in fertility with precision. Most evidence indicates that the fertility decline started to gain momentum only during the 1960s and, for the rural population, probably dates largely from the latter part of that decade.

A decomposition of changes in the crude birth rate between the mid-1960s and mid-1970s suggests that changes in the age structure and in the proportion married among women in the reproductive ages probably acted in counterbalancing ways and that neither was an important contributor to the changes in the crude birth rate. A modest increase in the proportions remaining single among women in the younger reproductive ages seems probable and thus helped to lower the birth rate; minor changes in the age structure probably had the opposite influence. Thus the recent decline of fertility in Thailand is predominantly a matter of reduced childbearing within marriage.

Between the late 1960s and the early 1980s, survey evidence indicates that marital fertility fell by almost 40 percent, representing one of the most rapid fertility transitions in the developing world. This reduction in

marital fertility is supported by data showing decreases in the percentage of women who are currently pregnant and increases in the average length of the open birth interval. Reductions in the expected number of children during the last decade both reflect the continuing fertility decline and, especially among younger married women, imply continuation of the recent fertility trends, at least for the near future. By 1981, the average expected family size among married women under age 25 had fallen to levels closer to two children than to three children and is only about half as large as the average number of living children among women currently reaching the end of their childbearing years. Moreover, it is approximately one child or so less than implied by the current total fertility rate.

One of the most striking features of Thailand's recent fertility decline has been its pervasiveness. Almost all major divisions of Thai society have participated. During the last decade or so, fertility decline appears to be even more pronounced in rural than in urban areas, thus narrowing the former substantial rural-urban differential in fertility levels. While regional differences have been apparent in both the timing and extent of decline, all areas of Thailand had at least started to participate in the fertility transition by the early 1980's. Moreover, fertility differentials by educational attainment and family income are minimal, reflecting the full participation of the least educated women and the poorest couples in the move toward smaller families. One group, however, that appears to be relatively resistant to the changing reproductive patterns is the small Moslem minority, many of whom live in southern Thailand, the most laggard region in terms of fertility decline. Since Moslems constitute only a very small proportion of the total population, their impact on national trends is minimal. The fact that Thailand's reproductive revolution encompasses such a broad social and economic spectrum may be related to the relative cultural homogeneity of Thai society. The exception of the Thai Moslems tend to confirm the importance of cultural rather than socioeconomic barriers to reproductive change in the case of Thailand. A fuller understanding of the source of the religious differentials may help clarify those features of the dominant Buddhist population that have made it so receptive to reducing fertility. This is an area of investigation that deserves more attention.

The focus of much of this study has been the proximate determinants of fertility: those variables that directly link childbearing to all other influences, whether socio-economic, cultural, or environmental. In our review of the proximate determinants we have divided them into three sets: factors influencing exposure to intercourse, natural marital fertility factors, and deliberate marital fertility control factors.

In Thailand, exposure to intercourse is largely a matter of family formation and dissolution, since most reproduction occurs within the context of marriage. Only scattered evidence is available on the extent of premarital sexual activity and illegitimacy. In rural areas, at least, premarital intercourse can lead to pressure to marry, especially when discovered by the young woman's parents. Methodological problems, however, prevent accurate estimates of the extent of premarital pregnancy being drawn from survey data currently available. Even less is known about the extent of illegitimacy, but it seems safe to conclude that extramarital births are not an important contributor to fertility overall.

Entry into marriage occurs, on average, in the early twenties for women and two or three years later for men. Age of marriage apparently has been increasing slowly since the Second World War, although not all information is consistent in this respect. For both men and women, marriage is close to universal, with only a few percent remaining single throughout the reproductive age span. At the same time, marital dissolution as well as remarriage are fairly common. Thus, a substantial minority of both men and women are married to someone other than their first spouse by the time they reach the end of the reproductive ages. Because remarriage is common and rapid, only a small amount of exposure time to childbearing is lost by women as a result of marital dissolution during the reproductive span. Some exposure time is also lost through the separation of spouses due to temporary migration, but again this is unlikely to be an important influence on fertility except perhaps in some special local circumstances.

Exposure to sexual intercourse is relevant to fertility, of course, only during the ages when men and women are biologically capable of reproducing. Thus some attention has been given in the present study to determine the biological age limits of reproduction. A review of studies with information on the onset of the menarche suggests that it is probably later in Thailand than in

most of the more developed countries. At least until recently the mean age has been perhaps as late as between 15 and 16 for large segments of the population. There is some limited evidence suggesting that the average age of menarche has declined in recent decades and also that an inverse association exists between socioeconomic status and age at menarche.

Less information is available on menopause in Thailand. One study of questionable quality suggests that it increased over the last few decades. Prior to the widespread practice of contraception, the mean age at last birth among women past the childbearing age was in the late thirties, which is within the usual range for natural fertility populations.

Other factors examined that could affect marital fertility independent of deliberate efforts at birth control were primary sterility, coital frequency and lactational infecundability. Primary sterility appears to be quite low: only a few percent of ever-married women at the end of the reproductive ages reported themselves as childless.

A variety of studies have collected information on coital frequency, but often the samples are quite specialized and the questions and methodology not comparable. As might be expected, these studies indicate an inverse association with age. The mean frequency of intercourse indicated by these studies ranges from slightly over one to close to three times per week.

Breastfeeding in Thailand is practiced close to universally, especially in rural areas. During the last decade or so, a moderate decline in the average duration has taken place, although still more than half of Thai women breastfeed for over one year. Supplemental food is introduced at an early age and probably reduces the potential inhibiting effect of the relatively long durations of breastfeeding on fertility. The median duration of postpartum amenorrhea, and hence the post-partum nonsusceptible period, is currently estimated at just under five months. Presumably, the decline in the duration of breastfeeding has operated against the prevailing trends toward lower marital fertility.

The most important proximate determinants responsible for the recent decline in Thai fertility have been those associated with deliberate marital fertility control, particularly contraception. There exists substantial information to document the relative absence of knowledge of effective birth control methods in the past, with the

possible exception of traditional techniques of abortion. However, contraceptive knowledge has increased rapidly in recent years to a point where it is now close to universal among married women. The practice of contraception has increased dramatically as well. At the end of the 1960s, less than 15 percent of married women in reproductive ages reported using some method of contraception; by 1981, this had increased to close to 60 percent. As with fertility decline, the increase in contraceptive use has been pervasive. Rural-urban, educational, or income differentials in contraceptive use are small at present. Moslem women are among the few identifiable groups that have lagged noticeably behind in their adoption of modern methods of birth control.

Only limited information is available on the practice of induced abortion. The scattered evidence that does exist suggests that it is relatively common despite the fact that many Thais express an overt disapproval of abortion, which they view as contrary to the precepts of Buddhism. The very scarce evidence also suggests that the practice of abortion has increased during much of the same period that contraceptive use has been on the rise. Most likely, both abortion and contraception have been used by Thais in meeting their increased desires to limit family size.

We have applied an analytical accounting scheme developed by John Bongaarts to data for Thailand in order to estimate the contribution of four principal proximate variables--proportions married, contraception, abortion, and lactational infecundability--to the level and change in Thai fertility during the recent period of fertility decline. The results indicate that the most important inhibitor of potential fertility during the late 1960s was the marital structure of the population. Lactational infecundability was the second most important factor, and contraception and induced abortion were relatively unimportant. By the end of the 1970s, however, contraception had clearly emerged as the most important inhibitor of potential fertility, followed by the marital structure, with more modest contributions being made by lactational infecundability and induced abortion. A decomposition of the fertility decline during the intervening decade indicated that reduced breastfeeding would have led to a 20-percent increase in total fertility had changes in the other proximate determinants not counteracted it. In contrast, changes in the proportion of women married and in induced abortion has contributed

modestly to the reduction in total fertility. By far the major factor accounting for the fertility decline has been the rise in contraceptive practice. Its contribution to fertility change during this period has been far greater than all other proximate determinants combined.

Why the fertility transition occurs where and when it does is a question that has intrigued social scientists and policy makers for decades. In the present study, we have made no systematic attempts to analyze the causes underlying the fertility decline in Thailand outside of the proximate determinants framework. We have pointed to evidence suggesting that the National Family Planning Program sponsored by the government has probably facilitated the rapid changes that have taken place. The development of an active program corresponds closely with the timing of the fertility decline in rural areas, a vast majority of Thai women report receiving their contraceptive supplies or services through the program and the analysis of service statistics indicates that the number of estimated births averted through the program can account for most of the observed fertility decline during the period under observation.

Regardless of how much of an impact the program has had on facilitating the fertility decline, a broader question arises as to why such a large proportion of Thai couples have been so receptive to adopting contraception and reducing their fertility in such a short period of time. The answer does not seem to be on the level of socioeconomic development, at least as conventionally defined, since even now the Thai population is overwhelmingly rural and agricultural. The full participation of couples with widely different socioeconomic backgrounds also suggests that the link to socioeconomic variables may be relatively weak. We suspect the pace of change is related to the cultural context in which it is occurring and to the rapid expansion of the communication and transportation network that now permeates virtually the entire country.

The rapid expansion of communication and mass transportation in recent decades is dramatic. Transistor radios are virtually a universal possession and televisions are becoming increasingly common even in the countryside. Minibuses and the extended road systems have also played a significant part in reducing the isolation of village life. Rural and urban Thais, the lesser and the better educated, the poor and the rich are all now exposed to a wide range of modern fashions,

consumer goods, and lifestyles. In response, aspirations, tastes, and attitudes have probably changed in a way that is incompatible with uncontrolled, high fertility. Coupled with an increased awareness that childbearing can be a matter of deliberate choice and with increasing local availability of contraception and perhaps abortion, these changes have led to rapid fertility decline. This occurred without large portions of the population moving to urban areas or working in the modern sector. Moreover, those shifts in socioeconomic structure that did occur surely further reinforced the newly emerging reproductive attitudes and behavior.

We also suspect the pace of decline has been facilitated by certain aspects of the Thai cultural context, in particular the Buddhist outlook on life and the position of women in Thai society. Buddhism as practiced in Thailand emphasizes that each individual is responsible for his or her own salvation and undoubtedly contributes to the general tolerance often associated with Thai culture. Religious opposition to contraception is virtually nonexistent. Attitudinal data clearly point to a widespread acceptance of the concept of birth control and family limitation. The permissiveness of Buddhist culture may well contribute to the relative ease with which modern tastes, attitudes, and behavior, including the modernization of reproductive patterns, are taking hold. Moreover, women in Thailand have traditionally experienced relative social and economic freedom. As a result, they are linked along with Thai men to the modern communication networks. Thus in various and increasing ways, even women in the rural hinterlands are exposed to the ideas and lifestyles that characterize urban centers and the world beyond. Since most of the contraceptive practices that have been responsible for the reduction of fertility in Thailand are female methods, and since the physical burden of childbearing and much of the burden of childrearing is borne by women, their exposure to the modernizing forces that are at work can and probably did have a strong impact on fertility.

There is substantial evidence to suggest that the fertility decline in Thailand is still in process. Declining family size preferences and expectations reinforce the impression that Thailand's fertility transition will continue for at least some years to come. The modal desired family size is now two children; the majority indicate a preference for a two-child family. Since very few Thais indicate a desired family

size of less than two, this may well set a limit on the extent to which fertility will decline in the intermediate future. In addition, the dominant preference for at least one child of each sex may also contribute to establishing a lower limit to the present fertility transition. Nevertheless, there is still considerable room for fertility to fall before these constraints will become major influences.

APPENDIX

DESCRIPTION OF SURVEYS AND SAMPLES

Much of the analysis of the present study relies on results from a series of national sample surveys conducted between 1969 and 1982. In this appendix, a brief description is provided for the surveys that served most frequently as data sources.

The National Longitudinal Study of Social, Economic, and Demographic Change (LS1 and LS2)

The Longitudinal Study, as it is usually referred to, was conducted by the Institute of Population Studies, Chulalongkorn University. It actually consisted of a total of four separate surveys done in two rounds. Interviews were conducted in a sample of rural households in April and May, 1969 and in a sample of urban households a year later. These two surveys make up the first round of the study and are referred to jointly in the present study as LS1. The second round of the study consisted of reinterviews as well as additional new interviews for the rural sample in April and May, 1972 and for the urban sample a year later. Together they comprise LS2. Both ever-married women and household heads (predominantly male) were interviewed in both rounds.

Sampling procedures and characteristics of the sample have been described in detail elsewhere (Prachuabmoh et al., 1973; Prachuabmoh et al., 1972; Institute of Population Studies, 1971). In both rounds of the Longitudinal Study, the urban population was defined as living within officially designated municipal areas and the rural population was defined as living outside these areas. The rural sample included 45 villages in 15 districts. The urban survey included 32 sample blocks in Bangkok-

Thonburi (the capital and only metropolitan area) and 24 sample blocks in provincial towns. This reflects the fact that well over half of the urban population resides in the capital. The villages and city blocks covered were identical for both rounds with the exception of three villages that had to be dropped from the rural sample because of antigovernment activities. In order to preserve the cross-sectional nature of the second round, these villages were replaced by three other villages in another district in the same province. For all other villages or blocks, houses selected in the first round sample were retained in the second round. In addition, a selection of new respondents was also interviewed to compensate for loss to follow-up and growth in the number of households between the two rounds. Thus the second round samples were designed not only to allow for longitudinal analysis but also to preserve the cross-sectional nature of the samples.

Results for the country as a whole can be approximated by combining the results of the rural and urban phases of each round. Since different sampling fractions were used to select the rural and urban samples, it is necessary to appropriately weigh the results of each sample when combining them. This is accomplished by assigning the urban sample a weight of one and the rural sample a weight of seven. No account is taken of the fact that for each round the rural and urban phases occurred one year apart, but this should be borne in mind when interpreting the results.

Survey of Fertility in Thailand (SOFT)

In 1975 the Survey of Fertility in Thailand (SOFT) was conducted under the auspices of the World Fertility Survey. Responsibility for the survey was shared jointly by the Institute of Population Studies at Chulalongkorn University and the National Statistical Office. Both ever-married women and household heads (mainly male) were interviewed. The bulk of the interviewing of SOFT took place during April and May, 1975. The sample consisted of over 4,000 households in both rural (nonmunicipal) and urban (municipal) areas selected from 267 clusters (234 villages in 78 districts of 34 provinces, 4 rural districts that are part of the Bangkok metropolis, and 29 urban blocks, 14 of which were in Bangkok). The result was approximately an equal probability national sample.

In the processing of results from SOFT for the present report, sample clusters were weighted to compensate for small original deviations from equal probability and also for differential nonresponse. A detailed description of the sample design and survey is available from the first country report (Institute of Population Studies and National Statistical Office, 1977).

The Contraceptive Prevalence Surveys (CPS1 and CPS2)

The National Institute of Development Administration (NIDA), in collaboration with the Family Health Division of the Ministry of Public Health in Thailand, conducted two Contraceptive Prevalence Surveys under contract with Westinghouse Health Systems. Fieldwork for the first survey, CPS1, took place November, 1978 through January, 1979. A detailed description of the sample and methods is provided in the final report of the results (Suvanajata and Kamnuansilpa, 1979). The simple, straightforward questionnaire used was designed to provide information that would assist family planning program administrators in determining the progress of family planning efforts. It thus differed in purpose and to some extent in content from the other surveys due to its more "applied" orientation. In addition, unlike the other surveys, single as well as ever-married women were interviewed. The total sample consisted of 4,025 women (including 1,032 single women). The rural portion of the sample was selected by procedures parallel to those used to draw the SOFT sample. A major concern in drawing the rural sample was to increase conparability with SOFT. Thus the provinces selected for the CPS sample were drawn from the list of 34 provinces included in the SOFT rural sample (excluding Bangkok). From each of the selected provinces, one district was drawn from those included in SOFT and the other was independently and randomly selected from the districts not included in SOFT. The final rural sample consisted of women from 136 villages located in 34 districts of 17 provinces.

The urban portion of the CPS sample was drawn entirely from the Bangkok metropolitan area. It thus differs in two ways from the urban samples of the other surveys. First, it excludes provincial urban areas from the sample. Second, it treats the entire Bangkok metropolitan area as urban while in the other surveys parts of this area are considered rural and are included in the rural portion of

their samples (since officially, some parts of the Bangkok metropolitan area are classified as nonmunicipal areas). The proportion of the total CPS sample that comes from the Bangkok metropolitan area is approximately equal to the proportion of Thailand's population that live in areas officially classified as urban (including provincial urban areas). Examination of results suggests that the use of a sample from the Bangkok metropolitan area in CPS to represent the entire urban population of Thailand has little effect on the representativeness of the sample on the national level. Comparison of results from the urban sample of CPS with those from the urban samples of the other surveys, however, is more hazardous and potential incomparability should be borne in mind when interpreting findings.

The second Contraceptive Prevalence Survey (CPS2) was conducted in 1981 from March through June with interviewing concentrated in April and May. The sampling procedures employed in CPS2 were designed to yield a self-weighting nationally and regionally representative sample. As with CPS1, the questionnaire had a more "applied" orientation so that the information collected would be more directly useful for the National Family Planning Program. Unlike CPS1, the sample of CPS2 covered only ever-married women. A detailed description of the sample and methods is provided in the country report (Kamnuansilpa and Chamratrithirong, 1982).

The total sample of CPS2 comprised 7,038 ever-married women aged 15-49. Multistage sample techniques were employed to select both rural and urban sample phases. The procedures used to select the rural portion of CPS2 sample paralleled those in CPS1 (which in turn was drawn from the list of 34 sample provinces in SOFT). In addition to the 17 provinces covered in CPS1, seven more provinces were randomly selected with probability proportional to size from the remaining provinces. Two districts were selected from each of the sample provinces. One of the two districts in each of the 17 provinces covered in CPS1 was randomly selected from the two districts covered in the first round, while the other was randomly selected from the remaining districts. Next, in each selected district, two sub-districts were drawn. Again, in the provinces which were also selected in CPS1, one of the two sub-districts was the same as the first round. In the new provinces, each sub-district was new. In the next step, two villages were randomly selected from each sub-district drawn in the previous stage. In

the sub-district which was selected in the first round, the two villages were the same as in the first round. The final rural sample of CPS2 consisted of 5,823 ever-married women from 192 villages of 96 sub-districts, 48 districts, and 24 provinces.

The urban sample of CPS2 was drawn from the Bangkok metropolitan area and provincial municipal areas separately. Thus, the urban portion of CPS2 unlike that of CPS1, is representative of all of urban Thailand and not just the Bangkok metropolitan area. Interviewing yielded a total of 765 respondents in the Bangkok metropolitan area and 450 in provincal urban areas.

The National Survey of Family Planning Practices, Fertility and Mortality (NS)

The National Survey was conducted in 1979 by the Institute of Population Studies, Chulalongkorn University, with interviewing concentrated in April and May. A description of the sample and methods is available in the summary report (Institute of Population Studies, 1981). The definition of rural and urban in the NS was in terms of municipal and nonmunicipal areas. The sample was somewhat unusual in design as it attempted to draw part of its respondents from the villages or city blocks included in the earlier LS2 samples and part of the respondents from new sample areas. In those LS2 sample areas selected, an attempt was made to reinterview former respondents from the previous survey. Some, but not all, of the villages and blocks, that had been part of the LS2 sample, as well as a number of new villages and blocks, were included. In the LS villages, lists of LS2 households were used in order to locate households with previous respondents. The sample design was such that in most LS villages all of the LS2 households should have been interviewed but attrition through death and migration had reduced the number, and these households were replaced through the sampling of reserve LS villages in different districts or provinces. The NS sample design also called for interviewing a number of new households in some of the LS villages, plus the new households interviewed in the new sample areas selected for the NS. In the urban LS areas the sampling fraction was much smaller than that used in LS2, with the result that only a relatively small proportion of the former LS households was selected for reinterview. For this reason, there was no need to select

new households in the urban LS areas and the small number recorded in this category was comprised of new households living in houses formerly occupied by LS2 households.

As a substantial portion of the sample is made up of households purposely selected because they took part in LS2, the NS sample does not provide a representative cross-section of the current national population. One result of the sampling procedure is a skewed age distribution, as members of LS2 households tended to be older than the average. Thus, among ever-married women in the reproductive ages, those at older reproductive ages are somewhat overrepresented relative to younger women.

The total NS sample consisted of 2,579 households: 2,144 in rural areas and 435 in urban areas. The sample covers 60 rural villages in 21 districts of 18 provinces (8 villages, while officially rural, are within the boundaries of the Bangkok metropolis). The urban portion of the sample derives from 56 blocks of which 32 are located in Bangkok and the remainder in 13 provincial towns. The rural and urban portions of the sample were self-weighting. Both household heads and ever-married women were interviewed.

The Accelerated Family Planning and Health Project Baseline Survey (AFPH)

Unlike the other surveys described so far, the AFPH survey was undertaken in conjunction with an action project and intended specifically to provide baseline information to be used as part of an effort to evaluate the impact of the project. Results are to be compared with those from a second survey in order to make a "before and after" type comparison. The project being evaluated is the Accelerated Family Planning and Health Project sponsored by the World Bank. The project is designed to accelerate the expansion of family planning and rural health services in 20 selected provinces that are characterized by low-to-moderate family planning acceptance, high population densities, and poor health facililty coverage and thus believed to require special attention.

Since the sample was drawn only from these 20 provinces, it clearly is not representative of all of provincial Thailand. Nevertheless, a sufficient number of provinces were covered to make it of interest. To help gauge how the 20 provinces differed from the total number of provinces, the table below presents a

comparison of the unweighted average of a selected number of indicators for the 20 provinces and for all provinces excluding Bangkok.

Mean of the Selected Provincial Measures	20 Provinces	All Provinces Except Bangkok
Percent of population in metropolitan areas, 1979	6.5	8.7
Electric consumption per capita	15.1	15.2
Percent of women aged 15-29 with 5+ years of school, 1970	7.7	10.8
Female literacy rate, 1970	74.2	72.4
Gross provincial product per capita, 1975-79 at 1972 constant prices (in baht)	3,980	5,463
Estimated continuing contraceptive users from National Program per 100 married women in reproductive ages, 1978-80	39.7	44.5
Percent of households with a radio, mid-1970s	66.6	65.7
Percent of households with a TV, mid-1970s	2.3	3.6

Currently married women in the reproductive ages (almost exclusively under 45) were interviewed in urban and rural areas of all 20 provinces. Fieldwork took place in October and November, 1979. A total of 750 urban women and 2,239 rural women were included. Since different sampling fractions were used to select the urban and rural samples, results presented for the total sample in this study have been weighted appropriately.

CONCLUDING COMMENTS ON SAMPLES

Because of the unusual age distribution of the NS sample and, to a lesser extent, because of differences in the age distribution of women in reproductive ages included in the other samples (see Debavalya and Knodel, 1978), it is useful to control for age when comparing results across surveys. This is done in the present study through age-standardization, using the age distribution of women as reported in the 1970 census for the whole country as the standard.

Several additional points regarding the samples should be stressed, as they bear on the comparability of results across surveys. In LS1, LS2, and NS, some districts were excluded from the sampling universe for various reasons. The excluded areas encompassed the four predominantly Moslem provinces of the south of Thailand and some districts in politically sensitive areas when it was judged that the safety of the interview teams might be in jeopardy. The areas excluded contain around 20 percent of the rural population and around 5 percent of the urban population. Their exclusion may affect some of the study results and their compatibility with the results from SOFT, CPS1, and CPS2, because the excluded rural areas are generally more isolated than the included areas and thus less exposed to the forces of modernization currently at work in Thailand. An even more serious problem exists for comparisons between the AFPH results and those of other surveys for the reasons discussed above.

A second point concerns sample size. Since the data from the surveys are derived from samples, the results necessarily incorporate some degree of sampling error and only approximate national parameters. Particular note should be taken of the fact that the size of the urban parts of the SOFT, CPS, and NS samples are considerably smaller than either the rural parts of those surveys or the rural and urban samples of the LS. In the latter, a

much larger sampling fraction was used for the urban sample than for the rural sample to compensate for the fact that less than 20 percent of the Thai population lives in municipal areas. There was no similar compensation in the other samples.

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COMMITTEE ON
POPULATION AND DEMOGRAPHY Report No. 14

The Determinants of Fertility in the Republic of Korea

Lee-Jay Cho
Fred Arnold
Tai Hwan Kwon

Panel on Fertility Determinants
Committee on Population and Demography
Commission on Behavioral and
Social Sciences and Education
National Research Council

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, about the existence and extent of recent changes in fertility, and about the factors determining reductions in fertility.

In 1963, a Panel on Population Problems of the Committee on Science and Public Policy of the National Academy of Sciences published a report entitled The Growth of World Population. The appointment of that panel and the publication of its report were expressions of the concern then felt by scientists, as well as by other informed persons in many countries, about the implications of population trends. At that time, the most consequential trend was the pronounced and long-continued acceleration in the rate of increase of the population of the world, and especially of the population of the poorer countries. It was estimated in 1963 that the annual rate of increase of the global population had reached 2 percent, a rate that, if continued, would cause the total to double every 35 years. The disproportionate contribution of low-income areas to that acceleration was caused by rapid declines in mortality combined with high fertility that remained almost unchanged: the birth rate was nearly fixed or declined more modestly than the death rate.

Since the earlier report, however, the peak rate of growth in the world's population has apparently been passed. A dramatic decline in the birth rate in almost all the more developed countries has lowered their aggregate annual rate of increase to well below 1 percent, and the peak rate of increase has also apparently been passed in the less-developed parts of the world as a whole. A sharp decline in fertility in many low-income areas has more than offset the generally continued reduction in the death rate, although the rate of population increase remains high in almost all less-developed countries.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the Committee on Population and Demography was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks; it initiated work on the third task in October 1979 when the Panel on Fertility Determinants was established.

As of early 1982, 168 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee approaches the first task through careful assessment, by internal and external comparison, and through analysis, by application of the most reliable methods known, of all the data sources available. Each of the country studies therefore consists of the application of a range of methods to a number of data sets. Estimates of levels and recent trends judged to be the best that are feasible with available resources are then developed on the grounds of their consistency and plausibility and the robustness of the individual methods from which they were derived.

The committee's second task, refinement of methodology, is seen as a by-product of achieving the first. The application of particular methods to many different data sets from different countries and referring to different time periods will inevitably provide valuable information about the practical functioning of the methods themselves. Particular data sets might also require the development of new methodology or the refinement of existing techniques.

The third task of the committee, evaluation of factors determining birth rates, is the most difficult. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the committee and the Commission on Behavioral and Social Sciences and Education established the separately funded Panel on Fertility Determinants, which includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel.

This report is one of the panel's country studies. It has been prepared by Lee-Jay Cho, director, East-West Population Institute, East-West Center; Fred Arnold,

assistant director for Professional Education, East-West Population Institute; and Tai Hwan Kwon, director, Population and Development Studies Center, College of Social Sciences, Seoul National University.

Much of the work on this study was carried out at the East-West Population Institute. Tai Hwon Kwon visited the Institute for two extended periods during 1981 to work on the study. In addition, work on the study was conducted at the Population and Development Studies Center, Seoul National University. The panel and the committee are grateful to these institutions for logistical support provided to the authors.

The authors, panel, and committee would like to thank Jae-Young Park, Soon Choi, Hee-Pyo Lee, and Nam-Il Kim for their assistance and suggestions; Jane Menken and John Knodel for comments on an earlier draft of this report; Robert Hearn for editorial assistance; and Kathy Martinez for typing the draft manuscript. The draft report was discussed at a country studies workshop organized by the panel in January, 1982, with financial assistance from the Rockefeller Foundation. Authors of the several panel country studies provided ideas and commented on the Korea study at that workshop. Finally, panel and committee reviewers provided advice and suggestions.

Several members of the panel and committee staff assisted in the preparation of this report. Appreciation is expressed to Carole Turley and Irene Martinez, who helped type the text and tables, and to Rona Briere, who edited the report. Elaine McGarraugh handled the production editing details with her usual precision and alacrity.

W. PARKER MAULDIN, Chair
Panel on Fertility Determinants

SUMMARY

Until the turn of the century, Korea was basically a traditional agricultural society, maintaining political and social stability with virtually no external contact, and frequently referred to as a "hermit kingdom." From the perspective of the demographic transition, this period (characterized by high mortality and fertility levels resulting in almost negligible growth) was the pre-transitional stage. Historical records show that from the sixteenth to the nineteenth century the population fluctuated between 5 and 7 million.

The beginning of the demographic transition in Korea may be considered as covering the several decades prior to the end of World War II. The level of mortality slowly declined with the benefit of Western medical technology and the introduction of public health measures under Japanese colonial rule. This moderate reduction in the death rate and the continued high birth rate contributed to significant population growth. In 1944, toward the end of the Japanese occupation, the size of the population in the Korean peninsula was approximately 25 million.

The period from the partition in 1945, which divided Korea along the thirty-eighth parallel, to 1955, when the first simplified census was conducted, embraced post-World War II political and social unrest and confusion, heavy return migration from abroad, the destruction and disruption caused by the Korean War, and the consequent dislocation and movement of the population. This period may be regarded as a "dark age" in the availability of population data. Although Korea's vital registration statistics are still incomplete and deficient, demographers have recently developed, refined and generated other types of demographic statistics, based

largely on census and survey data, that have permitted adequate fertility and mortality measurements. A series of censuses, taken almost regularly every five years from 1955, has provided a sufficient basis for refining own-children fertility estimates; numerous KAP and specialized demographic surveys conducted in the 1960s and 1970s have served as a useful check on these census estimates, and have also provided a rich source of information on fertility determinants. The high quality of age data from Korean censuses, combined with this intense technical demographic analysis of census, survey, and vital registration data, has permitted accurate estimates of fertility and of its differentials over time.

The present examination of available fertility data has shown that the TFR changed little from 1930 to 1960; due to balancing trends in the proportions married among women of childbearing ages and marital fertility. The rather low level of marital fertility during the 1930s, which was only 54 percent of Hutterite fertility, increased by almost 25 percent by 1960; apparently changing breastfeeding practices, in particular the abandonment of very long nursing, contributed to reducing long birth intervals and hence to increasing marital fertility. During the same period, the proportion married as measured by Coale's I_m index declined by 21 percent. The Korean War years (1950-1953) witnessed a slightly lower birth rate, which continued until 1957. Fertility then increased in the late 1950s, reaching its highest level around 1960 with a TFR of about 6, which is equivalent to the level observed for the pre-World War period of 1925-1945. After the Korean War the level of mortality, especially infant and child mortality, declined precipitously, and population growth peaked at an explosive rate of 2.7 percent during the intercensal period of 1955-1960. By 1960, the population of the Republic of Korea had increased to 25 million.

Between 1960 and 1980, a major demographic transition took place in the midst of rapid social and economic change. After 1960, fertility took a dramatic downturn; despite this decline, however, by 1980 the population had increased to 38 million, representing a growth of 52 percent in 20 years. The rapid fertility decline continued until 1967 and then slackened for the next five years; there was another sharp decline in the period 1972-75, but for the most recent intercensal period of 1975-80, the decline has been less rapid. The resulting 1980 TFR of 2.9 and CBR of 22 were both about half their respective levels in 1960.

Roughly paralleling these fertility declines, ideal family size has been cut in half in slightly more than two decades. The ideal range of three to five children common in the 1960s has now dropped to a norm of only two to three; more than three fourths of women who already have two children do not want any more. Moreover, women now prefer to have their children in rather quick succession after marriage and to complete childbearing at a relatively young age.

During the latter half of the 1960s, first, second, and third birth intervals decreased sharply. Estimates of fertility by duration since first marriage indicate that birth rates rose sharply at shorter durations and fell precipitously at higher durations during the 1960s and the first half of the 1970s.

The decline of cohort fertility has been less dramatic than that of either period fertility or ideal family size. For real cohorts of women who reached aged 45-49 in 1975, the peak childbearing years below age 30 occurred before 1960, when marital fertility was still very high and had not yet begun to decline. Therefore, completed family size at ages 45-49 for real cohorts, based on census data on children ever born, did not decrease nearly as dramatically as the TFR based on period fertility measures. The figures on children ever born show considerable inertia since they embody, particularly for older women, a good deal of high-fertility experience that occurred prior to the onset of the marital fertility decline in the 1960s.

In examining areal differentials, the present study found that although fertility declines occurred in all localities, these were only slight in some places, particularly in the least modernized part of the country along the east coast and in the rural areas of the less-developed southwestern regions. In the 1960s, both socioeconomic factors and IUD acceptance had a negative impact on marital fertility in rural areas; however, the effect of socioeconomic status is not discernible among younger women; and IUD acceptance had a greater negative impact on fertililty in communities with relatively low levels of socoeconomic development.

Applying a decomposition procedure, this study has examined the two principal components of change in the TFR from 1960 to 1975: changes in population composition by marital status and changes in marital fertility. The results show that the decline in marital fertility after age 30 accounts for most of the change in the TFR; for

the period 1966-70, a rise in marital fertility at ages below 30 acted to increase the TFR. Changes in the proportions married were responsible for about one fourth of the fertility decline over the period 1960-75. It is interesting to note that decreases in the proportions married at ages below 30 contributed to the TFR reduction, while increases in the proportions married at ages 30 and over acted in the opposite direction over the entire period. The fact that most of the decline in the TFR since 1960 is accounted for by the reduction of marital fertility is consistent with the fact that age at marriage was already quite late by 1960 and increased only moderately after that time.

When the variables of education and residence were added in the decomposition of the TFR change from 1960 to 1975, it was found that the reduction in marital fertility contributed heavily to the TFR decline (73 percent), and that most of the remaining decline was due to education. Place of residence was less important than education, and changes in marital status had a negligible contribution. Much of the explanatory weight of changing marital status shifted to education; this is plausible since the rise in educational levels resulting from longer schooling tends to delay age at first marriage.

Many factors have been suggested as influencing Korea's fertility decline over the last two decades. These include rapid urbanization, socioeconomic development, declining infant and child mortality, the changing status of women, increasing female labor force participation, rising educational attainment (especially of women), high educational aspirations for children, a rise in consumer aspirations, improved transportation and communication, increasing family nucleation, rising age at marriage, the diffusion of modern contraceptives, the easy availability of abortions, a decrease in the value of children as productive agents and sources of old age security, and the high cost of raising children. Since massive economic, social, and demographic changes have been occurring simultaneously in Korea, it is not easy to sort out clearly which of these factors have been most influential in the country's rapid decrease in fertility levels. In the present study, it was found that among the proximate determinants of fertility, family planning, abortion and, to a lesser extent, rising age at marriage share substantial responsibility for Korea's fertility decline, although social and economic changes have also contributed

to the fertility decline. These three primary factors are discussed below.

FAMILY PLANNING

The national family planning program was first established in 1962, and the government set a target of reducing the annual rate of population growth from 2.8 to 2.0 percent by 1970. The program initially concentrated on motivation and a "massive enlightenment" campaign and subsequently developed a national network of family planning field workers to promote program acceptance. The predominant method used at first was the IUD because it was the only effective method known to the program administrators, because it was relatively simple to administer, and because its acceptance marked a serious decision by the individual to control births, hence initiating an important behavioral change. By 1967, over one million loops had been inserted, and the annual number of IUD acceptors had risen to 229,000. Distribution of oral contraceptives began in 1968 when the IUD drop-out rate was rising and there was an increasing need for alternative methods; women who discontinued the IUD were eligible to receive the pill after three months. Pill acceptance increased, and by the end of 1970, 276,000 women were using this method. The upsurge in sterilization, which was particularly marked in urban areas, occurred only after 1972. A dramatic surge occurred in female sterilizations during the period 1975-77, when the sterilization rate rose fom 11 to 53 tubal ligations per 1,000 ever-married women aged 20-39; this increase can be atttributed to the introduction of laparoscopy in the government program and a tripling of government payments to physicians performing the procedure.

From 1968 to 1978, the Planned Parenthood Federation of Korea established and operated "Mothers Clubs" in the rural areas, basically to overcome traditional resistance to smaller families and to encourage modern contraceptive practice. Specifically, the Mothers Clubs facilitated family planning communication, recruited acceptors, provided better access to contraceptives, created a favorable community climate for the acceptance of contraception, and assisted in the work of family planning field workers. When actively functioning, these clubs played an important role in the successful implementation of the national family planning program, especially in rural areas.

The contraceptive practice rate for currently married women increased 2.7 times (from 20 percent to 54 percent) from 1966 to 1979. During this same period, a rapid urban-rural convergence in contraceptive practice was taking place; currently, there is virtually no urban-rural differentiation in contraceptive practice rates. The dramatic increase in family planning practice in rural areas is largely due to the fact that the national program was oriented toward the traditionally high-fertility rural areas. There has also been a gradual disappearance over time of educational differentials in contraceptive practice in both urban and rural areas.

By 1978, among currently married fecund women who wanted no more births, 26 percent were sterilized, another 29 percent were using other efficient methods such as the pill and the IUD, and the remaining 45 percent were either using inefficient methods or not using contraception at all. Many women in the last group had an abortion to prevent the birth of an unwanted child, as discussed below.

INDUCED ABORTION

Induced abortion has been a very important factor in Korea's fertility transition, at least since 1960; before the national family planning program in 1962, abortion was the only effective method of fertility control, but was rarely practiced. Induced abortion has contributed to the fertility decline in two ways: it has been practiced as a direct means of avoiding unwanted births, and it has been used as the final resort when other contraceptive methods failed. The success of the Korean family planning program has been due significantly to easy access and the absence of cultural and social barriers to induced abortion. Abortion has been particularly effective in conjunction with contraceptive practice. In fact, the increasing acceptance of induced abortion in the face of rising contraceptive use suggests that abortion is highly compatible with other means of fertility control. This study found that the patterns of abortion practice among various age and socioeconomic groups are distinct from those of contraceptive use and sterilization: abortion has occurred in a wider range of ages, but has been more selective in terms of the couple's socioeconomic status. Moreover, although contraception and abortion are compatible, a considerable proportion of

women rely entirely on abortion to limit their family size.

The contribution of induced abortion to Korea's fertility decline was most pronounced in the early 1960s; since that time, family planning has had more of an impact. One estimate indicates that impact of induced abortion on fertility reduction was equivalent to 3 percent of the actual TFR in 1960, 14 percent in 1965, and 18 percent in 1970, and that the impact was greater in urban than in rural areas.

AGE AT MARRIAGE

With modernization and the mortality transition, the marital composition of the Korean population has changed substantially. The proportion of curently married women (as well as men) has decreased rapidly in the early reproductive ages (up to age 24) due exclusively to the postponement of marriage, and has increased substantially at later ages as a result of a continuous reduction in the spouse's risk of dying. Both of these changes have implications for fertility, although the impact of the former is far more significant.

On the other hand, there is evidence that this postponement of marriage has caused an increase in fecundability in the early years of marriage. In addition, the transition of early to late marriage has been accompanied by a growing incidence of premarital pregnancy. These two forces have tended to counteract the depressing influence of a rising age at marriage on the level of fertility in Korea.

Changes in basic marriage institutions, aside from the timing of marriage have been very minor. In traditional Korea, "familism," derived mostly from the neo-Confucian principles of Chu-shi, governed every aspect of social life. Universal marriage is still strongly endorsed and the extent of divorce and remarriage has changed little during the last twenty years of the fertility transition in Korea. The Korean family is still characterized by a patriarchal, patrilineal and patrilocal system, and strong solidarity among family or kinship members. These characteristics have in turn generated a strong son preference and orientation toward large families. Among sons, the first son is most valued since he alone can fulfill most of the son's customary functions. The rapid shift in family-size and fertility attitudes in Korea

without concomitant changes in son preference may be explained by the fact that only one or two sons are necessary to ensure the fulfillment of these functions and that daughters are often considered unessential.

OTHER DETERMINANTS OF FERTILITY

Rapid urbanization has played an important role in Korea's fertility decline, but will probably be less important in the future. As in many other countries, fertility declined more rapidly in urban areas in the early stages of the fertility transition; more recently, however, rural fertility has declined at a considerably faster pace. As noted above, rural-urban fertility differentials have been converging over time, and contraceptive use rates for both areas are now nearly identical. Although educational attainment exhibits the usual strong inverse relationship with fertility, there has been some convergence in these differentials as well. Income does not seem to have much of an effect on fertility once other factors are controlled.

Mortality appears to have had a substantial impact on fertility in the past, although direct empirical evidence is generally lacking. The rapid decline in infant and child mortality has undoubtedly contributed to the fertility decline, although further changes in mortality are unlikely to have much effect; infant mortality has now reached such a low level (less than 40 per 1,000) that the fear of child mortality is no longer a major factor in childbearing decisions.

Female labor force participation rates are rising, and Korean women work longer hours on average than women in any other country in the world. The effect of women's work on fertility, however, is somewhat inconclusive. The kind of work a woman engages in and the degree of compatibility between her work and childrearing are more important than whether she works or not. Although women have often been able to rely on their extended family or hired domestic help to care for children while they work, the increasing nucleation of Korean families and the high cost of maids in urban areas are beginning to limit these options.

The productive utility of children as workers for the family farm or business or as family income producers is declining in Korea. Although parents still expect a moderate amount of economic and practical help from their

children, this is generally viewed as a normal concomitant of raising children rather than a reason for having them. The security utility of children, particularly for support in old age, is still strong but declining; children are often expected to provide supplemental help rather than total support.

On the cost side, parents are acutely aware of the high costs of raising children (particularly the educational costs) and these can be an important factor in fertility decisions. The urban poor seem particularly vulnerable in this respect because of their low incomes and the high cost of living in the cities. Although the opportunity costs of raising children are not large, these will probably increase over time. Parents often mention the emotional and physical burdens that they would have to cope with if they had more children; however, there is evidence that these burdens are not entirely anticipated before couples have begun childbearing.

In addition to the many factors discussed above, this study has also explored some countervailing forces that may have kept fertility from falling even more rapidly and that may make future declines more difficult to attain. During the last several decades, there have been significant changes in breastfeeding practices. The abandonment of very long breastfeeding apparently began early in the fertility transition; presently, only a small proportion of women continue very prolonged nursing, although the majority continue to nurse for moderately long periods of nine months or more. Associated with this phenomenon is the fact that birth intervals at early parities have become substantially shorter as more educated and higher-income couples have accepted bottle feeding. It is expected that declines in either the incidence or length of breastfeeding in the future would tend to increase fertility rates.

The likely effect of continued son preference is more ambiguous. Fertility has declined precipitously in Korea in the face of no more than a gradual decrease in this traditional attitude. Some speculate that there is no reason for son preference to provide a drag on further fertility declines; others feel that the greatest effect of boy preference will be at the second and third parities (i.e., in decisions about whether to have a third or fourth child), and that additional fertility declines are therefore unlikely.

Evidence on the influence of community and ecological factors is mixed. Studies adding community-level

variables to individual records on survey data files have been unable to prove a link between these variables and fertility, although flaws in the design of these studies may be responsible for this result. Aggregate- level analyses relating areal characteristics to areal fertility levels have been more successful. The most significant results have been derived from an anthropological study that highlighted structural and institutional factors in comparing different communities.

PROSPECTS FOR FUTURE FERTILITY TRENDS

A rapid fertility transition has been observed in a number of Asian countries in addition to Korea, including Japan, Taiwan, China, Hong Kong, Singapore, and the Chinese population in Malaysia. All of these populations share the so-called Chinese cultural influence. Japan, an industrial state, has completed its demographic transition, while the newly industrializing countries of Korea, Taiwan, Hong Kong, and Singapore have all experienced rapidly falling levels of fertility along with rapid economic and social development. It is basically a matter of time before these countries also complete their demographic transitions. Although it is extremely difficult to isolate the cultural factors that have contributed to this common pattern of fertility change, such shared characteristics as the absence of barriers to ready acceptance of abortion and sterilization and the universality of marriage might be highlighted. Other shared characteristics include cultural homogeneity in ethnicity, language, and religious tradition, and geographic and political unity. These characteristics in turn promote social integration in the form of efficient communication and shared values, norms, and institutions. In this way, Korea meets the conditions proposed by Retherford (1981) as conducive to a sudden and rapid fertility decline.

In general, economic and social development results in lower mortality and in the reduced productive and security utility of children. These changes are accompanied by a smaller desired family size, creating the conditions for fertility decline even in the absence of a national family planning program; thus economic and social development may be the fundamental cause of fertility transition. However, although this developmental change has facilitated Korea's fertility decline, the family planning

program has expedited the process. Korea's national family planning program was initially very effective in legitimizing family planning, and consequently in reducing the "normative costs" of birth control in a short period of time; family planning leaders subsequently worked successfully to diffuse birth control throughout the country.

Prospects for future fertility trends are uncertain. All of the variables examined in this report indicate favorable conditions for further fertility decline, except for three factors: (1) the universality of marriage, (2) the reduction of the incidence and duration of breast-feeding, and (3) the continued strength of son preference. The impact of these three factors can be expected to be significant, especially in the fertility transition from a TFR of three to the replacement level; however, this impact will probably be insufficient to entirely curtail the fertility decline. The course of fertility in the last two decades has not been uniform: there was a sudden fall in the early 1960s, followed by a temporary slackening in the late 1960s, another rapid decline in the early 1970s and a moderate decline in the last few years. Korean fertility will complete its transition to the replacement level in the years to come, although, because of the three factors mentioned above, further declines are not likely to be achieved without some temporary setbacks.

CHAPTER 1

INTRODUCTION

In the last several decades, Korea has experienced great political, economic, and social changes. It has also witnessed one of the fastest fertility transitions in the world. Research on Korea's rapidly changing fertility has proliferated during the last two decades. This study will review the relevant research and organize the data in such a way as to (1) put this fertility transition into a proper perspective; (2) shed light on some of the important questions that remain unanswered; (3) examine, at both the micro and macro levels, various determinants of fertility and factors contributing to rapid fertility change; and (4) make some generalizations about the past and provide some speculation and perspective on Korea's future fertility trends. The following are some of the questions addressed in this report:

1. What was Korea's fertility level in the past, and what is that level today?
2. How fast has the fertility change occurred?
3. What factors have determined or are associated with past and current levels of fertility?
4. What are the explanations for the observed changes in fertility?
5. What are the prospects for fertility change in the future?
6. Has the observed demographic change been independent of economic and social changes?
7. Can fertility change be induced?

BACKGROUND

Korea, a small peninsula off Manchuria, China, in Northeast Asia, has a national history going back thousands of years. Located among the major historical powers in Asia, the country has on several occasions suffered from foreign invasion and domination; nevertheless, it has succeeded in maintaining and preserving its culture, language, values, and traditions. Its people are ethnically, culturally, and linguistically homogeneous.

The Yi dynasty began at the end of the fourteenth century and ended when Japan succeeded in annexing the Korean peninsula in 1909. Japan's occupation lasted 36

years and ended with the defeat of the imperial forces in World War II. At that time, the Soviet Union occupied the country north of the 38th parallel, and the ideological struggle emerged that finally led to the political division of the peninsula. In 1950, the Korean War broke out and destroyed what was left of the colonial industrial base developed by Japan.

The devastation of the war during the years 1950-53 left the nation on the edge of survival. By 1961, recovery had still been modest and per capita income stood at U.S. $82 (see Table 1). Demands of minimum living standards left little room for investment out of this small income, and fixed capital formation averaged a mere 10 to 12 percent of the GNP, levels about as low as those in the poorest nations of the world (Korea, Economic Planning Board, 1980). In less than five years, however, the economy began a spiral of rapid growth that continued until 1979. By 1968, nearly a quarter of the Korean GNP was being channeled into a massive program of capital expansion and modernization. The result has been growth in productivity averaging 6.1 percent per year. This increase in productivity, combined with a labor force increasing at 3.6 percent annually and the gradual reduction of unemployment, has produced an annual growth rate in real GNP of over 10 percent, a rate that rivals even that of booming, prosperous Japan.

A number of indicators provide evidence of the profound changes that took place during the last two decades (see Table 1). The population increased by 50 percent between 1960 and 1980, with the average annual intercensal growth rates declining substantially from 2.7 percent during 1960-66 to 1.5 percent during the 1975-80 period. Despite this substantial population growth, the country has experienced rapid modernization and improvement in living standards. Improvements in medical and public health facilities contributed greatly to a dramatic reduction in infant and chilhood mortality and a substantial increase in life expectancy. Female life expectancy, already quite high at 61 years in 1960, increased to 69 by 1978-79.

The urban population in Korea rose from 28 percent in 1960 to 57 percent in 1980. Rising urban demand for farm products, coupled with modern farming methods and government support for agricultural prices, has now raised farm income to levels comparable to those in the city. Still, the movement of people from rural to urban areas continues at a rapid rate even today.

TABLE 1 Selected Socioeconomic Indices: Republic of Korea

Index	1960	1966	1970	1975	1980
Population (millions)	25.0	29.2	31.4	34.7	37.4
Average annual population growth rate since previous census (percent)	--	2.7	1.8	2.0	1.5
Density (per km2)					
Overall	256	299	327	357	385
Arable land	1,166	1,262	1,339	1,477	1,592
Female life expectancy (years)	61	64	67	70	69[a]
Percent urban	28	34	41	48	57
Percent of women aged 15-49 who have more than a primary education	12	21	30	42	--
Percent of children aged 6-11 who attend school					
Urban	80	88	87	89	--
Rural	72	84	88	90	--
Per capita income (U.S. $)					
Current prices	82[b]	125	243	574	1,597[a]
1975 prices	241[b]	307	408	574	810[a]
Percent of employed population working in secondary and tertiary industry	37[c]	42	50	54	66
Electric power (KWH) per person	69[b]	132	284	562	946[a]
Radios per 1,000 households	121[b]	214[d]	525	857[e]	--
TV sets per 1,000 households	5[b]	9	65	259	850
Telephones per 1,000 households	28[b]	61	93	173	242

[a]Value is for 1979 instead of 1980.
[b]Value is for 1961 instead of 1960.
[c]Value is for 1963 instead of 1960.
[d]Value is for 1965 instead of 1966.
[e]Value is for 1974 instead of 1975.

Source: Cho and Retherford (1981).

Traditionally, Koreans have placed a high value on education and literacy. They are also noted for their work ethic. Since almost everybody has a basic education, the vocational skills and professional training needed by a growing economy are easily acquired. During the last three decades, there has been great progress in the education of the population. The proportion of women in reproductive ages with more than a primary education (six years) increased from 12 percent in 1960 to 42 percent in 1975. The proportion of children age 6-11 attending school increased from 72 percent in rural areas and 80 percent in urban areas in 1960 to about 90 percent in both areas in 1975. Girls had much lower attendance rates than boys in 1960, but this sex difference had virtually disappeared by 1975.

Despite the growing population during this transition period, the increase in productivity has kept output per person expanding at a phenomenal 8.3 percent per year. Real per capita income more than tripled between 1960 and 1979. Today, per capita GNP stands at over U.S. $1500. Rapid economic growth has contributed to rising real incomes at all levels. The real monthly earnings of manufacturing workers, for example, rose at a rate of 4.3 percent annually, and overall income has been more equally distributed among families than in other nations of equivalent income.

The proportion of employed persons working in secondary and tertiary industries increased from 37 percent in 1963 to 66 percent in 1980. From 1961 to 1979, per capita electric power consumption increased more than 13-fold; per capita radio ownership more than 7-fold, to almost one radio per household in 1974; per capita television ownership more than 170-fold, to almost one set per household in 1980; and per capita telephones more than 8-fold, to almost one telephone for every four households in 1980.

The female work force has also contributed to Korea's development. The overall female labor force participation rate rose from 38 to 42 percent in the ten years between 1968 and 1978; the rate for farm females rose from 45 to 51 percent, and for nonfarm females rose from 30 to 36 percent. The participation rate for males remained constant at 76 percent (Korean Institute for Family Planning, 1978:255-256).

Korea has one of the highest population densities in the world. Population density on arable land increased from 1,166 per square kilometer in 1960 to 1,592 in 1980

(see Table 1). By way of comparison, density on arable land was about 50 in the United States and 793 in Bangladesh in 1974 (United Nations, Food and Agricultural Organization, 1975). These figures indicate the strong population pressure on Korea's agricultural resources.

ORGANIZATION OF THE REPORT

The remainder of this Introduction provides a brief demographic history of the country, followed by a review of available sources of population data. Chapter 2 focuses on estimates of fertility levels and trends during the last two decades and the decomposition of fertility change into its components. Chapter 3 brings together the information contained in the first two chapters to examine the relationship between changing socioeconomic conditions and changes in fertility attitudes and behavior. The importance of changes in family structure and marriage patterns is explored in Chapter 4, and the changing value of children and the influence of son preference on fertility are discussed in Chapter 5. Chapter 6 outlines the development of Korea's family planning program, highlighting changes in family planning practices and the use of abortion services. The summary at the beginning of this report discusses what is known about the determinants of fertility and speculates about the future course of fertility trends in Korea.

Korea's Demographic History

Korea's early historical records indicate that some form of registration of households and population was carried out for purposes of taxation and military conscription. Evidence of more systematic, census-like registration is available for the Yi dynasty, beginning in the fourteenth century. It is obvious that early in this period, household registration covered only part of the country and was subject to a great number of omissions and evasions, largely due to efforts to avoid taxation and conscription.

Apparently, by 1672 registration had become country-wide and considerably more complete. The census in that year counted 1,205,000 households and a population of 4,720,000, or 3.9 persons per household (Eisuke, 1925). As shown in Table 2, the population trend was consistent over numerous census periods from 1672 up to the turn of

TABLE 2 Households and Population, 1672-1920

Year	Households	Population	Male and Female Population	
1672	1,205,866	4,720,815		
1681	1,376,842	6,218,342		
1690	1,514,000	6,952,907		
1699	1,333,330	5,774,739		
1708	1,406,610	6,206,554		
1717	1,560,734	6,788,789		
1726	1,614,598	6,995,400		
1738	1,672,184	7,096,565		
1747	1,759,692	7,340,318		
1756	1,771,349	7,318,359		
1765	1,675,267	6,974,642		
1774	1,703,030	7,098,441		
1783	1,733,757	7,316,924	males:	3,563,685
			females:	3,753,239
1807	1,764,504	7,561,403		
1864	1,703,450	6,828,521		
1910 (end of year)	2,804,103	13,313,017	males:	7,057,458
			females:	6,255,559
1915 (end of year)	3,117,692	16,278,389	males:	8,370,940
			females:	7,907,449
1920 (end of year)	3,297,126	17,264,119	males:	8,903,000
			females:	8,361,119

Source: Eisuke (1925).

this century, although the quality of the last few censuses must have deteriorated considerably because of the domestic and international political turmoil. Over this roughly 200-year period the Korean population showed a very low rate of growth--0.25 percent per annum. In 1777, the census counted males and females separately for the first time, enumerating 3,537,786 males and 3,700,737 females (a sex ratio of 95.6); this low ratio may well be attributable to census evasion on the part of younger men who feared military conscription.

From the historical records, there is no way to determine the levels of fertility and mortality prior to the first modern census in 1925. It is known from the Yi dynasty household registration that the average household size fluctuated between 3.9 and 4.6, which is lower than today's level. It is also known that marriage was nearly universal, and that age at marriage for both males and females was very young. As mentioned earlier, population

growth was insignificant during the eighteenth and nineteenth centuries. Based on these facts it may be speculated that the fertility level was quite high, but that the level of mortality was also high, resulting in virtually no population growth. A large collection of Yi dynasty household registration records is available, showing household relationships, age, and sex. Historical demographic analysis of the Korean data, such as that done by Hanley (1979), has shed some light on the levels of fertility, family size, and mortality during this period.

In 1909, subsequent to Japanese annexation, the colonial authority made a year-end population count that showed a population of 12.9 million; this is a substantially higher figure than the last count of the Yi dynasty, especially considering the fairly large exodus of migrants out of Korea into China, Russia, and other places. From 1910 to 1923, the year-end population counts showed population growth in the range of 13.3 million to 17.9 million. The year-end count is not a census, but an administrative count based on the canvassing of households and also on police and civil registration records (Choe, 1967:29-30). Although these counts did not achieve complete coverage (in the period 1911-25, coverage varied from 92 to 97 percent), they have provided a sufficient basis for estimating trends in population size and growth.

By 1925, when the first modern census was conducted by the Japanese colonial government, the population in the Korean peninsula was 19 million. Even with substantial migration out of Korea in the two decades following the 1925 census, the Koreans in the peninsula increased their number, and by 1944, according to the last colonial census conducted, the population was 25.1 million. From 1925 to 1944, the Korean population showed only moderate growth (1.4 percent), as indicated in Table 3.

Estimates of fertility have been made for the colonial period from the censuses of 1925 through 1940 by Chang (1966) and also by Kwon (1977: Chapters 5 and 7). The level of fertility was very high: the crude birth rate was estimated to be 46 per thousand during 1926-30, declining gradually over the next 15 years to 42 (see Table 4). During the colonial period, there was virtually no change in the total fertility rate (TFR), only a slight decline from 6.2 to about 6.1. An examination of estimated age-specific fertility rates reveals that women in all age groups except the youngest (15-19) maintained the same high fertility level during

TABLE 3 Population and Intercensal Growth Rates: All Korea, 1925-44 and Republic of Korea, 1949-80

Year	Population	Intercensal Growth Rate (percent)
All Korea		
1925 (October 1)	19,020,030	
		1.44
1930 (October 1)	20,438,108	
		1.66
1935 (October 1)	22,208,102	
		1.17
1940 (October 1)	23,547,465	
		1.41
1944 (May 1)	25,120,174	
Republic of Korea		
1949 (May 1)	20,166,756	
		1.20
1955 (September 1)	21,502,386	
		2.70
1960 (December 1)	24,954,290	
		2.49
1966 (October 1)	29,159,640	
		2.16
1970 (October 1)	31,438,768	
		1.96
1975 (October 1)	34,678,000	
		1.54
1980 (November 1)	37,500,000	

Sources: Cho (1973); and calculations based on the 1975 and 1980 census reports from the National Bureau of Statistics, Economic Planning Board, Seoul.

the four intercensal periods. Thus the minor decline in the birth rate can be attributed to the gradual rise in the age at marriage during this period. In traditional Korea, marriage took place at very young ages; between 1925 and 1940, mean age at first marriage for females rose from 16.6 to 17.8, while the proportion of females single in the age group 15-19 increased from 27 percent in 1925 to 37 percent in 1935.

TABLE 4 Estimated Completeness of Birth and Death Registration, 1910-65: Korea

Period	Birth Rate		Completeness of Birth Registration	Death Rate		Completeness of Death Registration	Natural Increase (per 1,000)
	Recorded Rate	Estimated Rate		Recorded Rate	Estimated Rate		
1910-15	24.6	45.3	54.3	15.7	33.7	46.6	11.6
1916-20	31.5	47.5	66.3	24.7	31.6	78.2	15.9
1921-25	36.3	48.0	75.6	20.8	29.5	70.5	18.5
1926-30	35.9	45.9	78.2	21.6	26.4	81.8	19.5
1931-35	30.9	45.5	69.9	20.3	23.3	87.1	22.2
1936-40	32.6	43.3	75.3	18.4	21.4	86.0	21.9
1941-45	35.3	42.1	83.9	19.2	19.5	98.5	22.6
1946-50	18.9	39.9	47.4	10.1	15.8	63.9	24.1
1951-55	23.9	41.0	58.3	7.3	14.3	51.0	26.7
1956-60	31.1	43.0	72.3	6.9	12.8	53.9	30.2
1961-65	30.9	39.5	78.2	7.5	10.5	71.4	29.0

Note: Data for 1910-45 are for all Korea; data for subsequent years are for South Korea only.

Source: Choe (1967).

The three colonial censuses of 1925, 1930, and 1935 for which data on marital status are available illustrate a remarkable phenomenon of universal marriage. By age 20 almost all females were married--only between 1 and 3 percent remained single--and beyond age 30 the proportion of women unmarried was insignificant. Koreans have traditionally placed a high value on marriage and family formation, both for men and women; remaining single beyond the so-called marriageable age has been greatly frowned upon and considered a great disservice to parents and family.

World War II and the end of Japanese colonial rule in 1945 brought about a great deal of change, including a substantial volume of migration across the new national boundaries. The Korean War (1950-53) caused further destruction, chaos, and social change. Because of the paucity of useful demographic or other relevant quantitative data, very little is known about social and demographic change during the years 1945 to 1954. In addition, since 1945, when Korea was divided along the thirty-eighth parallel, it has not been possible to follow population trends of the entire peninsula. For South Korea, the population increased between the 1944 and 1949 censuses from 16.2 to 20.2 million, indicating an annual growth rate of 4.4 percent. This unusually high growth rate was largely due to the return of Koreans from Japan and Manchuria following World War II and to heavy migration from the North during the period. The 1955 census, however, indicated only a slight increase in population size from 20.2 to 21.5 million, representing an average growth rate of 1 percent per year from 1949 to 1955. This period overlaps the Korean War, during which mortality was extremely high and there was a large volume of migration from the North to the South; the lower growth rate may also be due to lower fertility during the war.

The 1960 census enumerated 25.0 million persons; based on figures from the 1955 and 1960 censuses that have been adjusted for underenumeration, the estimated annual rate of intercensal population growth was 2.7 percent. The 1966 census enumerated 29.2 million; based on adjusted figures for both 1960 and 1966, the annual intercensal growth rate for the six-year period was 2.5 percent. The population grew to 31.4 million by 1970, with an intercensal growth rate, again using adjusted figures, of 2.2 percent. The 1975 census and the recent 1980 census enumerated 34.7 million and 37.5 million, respectively, implying intercensal growth rates of 1.96 and 1.54 percent for 1970-75 and 1975-80.

Data Sources

In Korea, there are basically three types of data available for the measurement and analysis of fertility: vital statistics derived from the registration system; indirect measurements of fertility from census data; and specialized fertility surveys and other surveys to which questions on fertility have been added.

Vital Statistics

As briefly mentioned earlier in this chapter, Korea has had some form of population registration from the earliest historical times; however, this was mostly confined to simply canvassing households and counting population for purposes of taxation and military conscription. The modern civil registration system and the collection of data on vital events date back only to 1910, and until 1937, vital statistics were compiled only as a by-product of the civil registration system. This statistical information covered only the number of vital events; the detailed vital statistics on births, deaths, and marriages that are available today were not collected.

Although a modern system of vital statistics was established in 1938 by the Japanese colonial government, it did not function as completely as the system in Taiwan under the same colonial rule. As shown in Table 4, birth registration was far from complete. During the ten years prior to the end of World War II, birth registration was relatively more complete: 75 percent in 1936-40, and 84 percent in 1941-45. Death registration was even better: 86 percent and 99 percent during the same periods.

After the liberation in 1945 and subsequent partition of the country, political and social instability prevented the new government from improving vital statistics. In fact, during the years 1946-50, the system deteriorated substantially; it is estimated that less than 50 percent of births and 64 percent of deaths were recorded in this period. During the Korean War, from 1950 to 1953, the system remained woefully inadequate and incomplete. Death registration further deteriorated during the postwar period. Although a number of factors contributed to incomplete vital registration, three that deserve mention are delayed registration of vital events, problems associated with the general use of the lunar calendar, and the inconvenience of obtaining certification of cause of death from a medical doctor.

The vital registration system gradually improved over the two decades from 1960 to 1980. Delayed registration of births and deaths became much less frequent, and the general public became more cooperative. Nevertheless, except for the last few years, birth and death statistics are not sufficiently complete and reliable to permit adequate fertility analysis. However, data for the 1980s should be sufficiently complete to serve as a basis for the measurement and analysis of Korean fertility and mortality.

Censuses

The first modern Korean census was conducted in 1925 under Japanese rule. From 1925 to the end of World War II in 1945, five censuses covering all of Korea were taken at intervals of five years, except for the last one, which was taken after four years. These censuses were of high quality and were consistent over the regular census intervals, and provide valuable data for demographic analysis. Two types of censuses were administered by Japan: a simplified census conducted in quinquennial years (those ending in a five), and a full census taken in years ending in zero. The former was limited to collection of basic demographic information such as age, sex, marital status, and nationality, while the full census covered additional socioeconomic characteristics such as education, occupation, and industry.

The census data on age in the colonial period were unusually accurate for a fascinating reason: Korea followed the Chinese dating system, using the lunar calendar--a 12-year cycle of 12 different animals--to determine age, and traditionally placed great significance on the date and time of birth. The Western solar calendar was introduced with the Japanese colonial occupation in the early part of this century; it has gradually been replacing the lunar system, but still has not done so completely because of cultural resistance. The early assumption of Westerners that rural Koreans would not know their exact ages is wrong. Korean parents record their children's dates of birth (and in most cases the hour as well) for the following purposes:

(1) Sajoo (literally translated as "the four pillars of a person"), meaning that the time, day, month, and year of birth determine a child's future. In the past,

some mothers would try to postpone a birth until a propitious hour of the day, although this practice is rare today.

(2) Samchil (literally, "three-seven"), meaning that for 21 (three times seven) days after birth, visitors other than close relatives are not allowed in the house. This was probably meant to minimize the child's exposure to disease. Although not strictly observed in the cities at present, the practice is still generally observed in the rural areas.

(3) Paegil (literally, "the hundredth day"), meaning that on the hundredth day after birth, close relatives and friends are invited to share food and drinks to celebrate the birth and survival of the child.

(4) Tol (translated as "first birthday"), meaning that the child has survived a full year since birth, an event that calls for celebration. The first and sixtieth birthdays are the two most eventful birthdays celebrated.

(5) Gunghap, meaning that, for a happy marriage, the sajoo of the bride and groom should be matched to see whether the combination is favorable. This custom is still widely practiced.

(6) Hwangap, meaning that on one's sixtieth birthday a man or woman has completed five twelve-animal-year cycles. This occasion calls for a big celebration.

These customs require an accurate record of the age of each member of the family. As in Japan, age heaping--a kind of age misreporting in which certain ages (often those ending in a specific digit), such as 5, 10, 15, 20, 25, are overreported, while others, such as 19, 23, 37, are underreported--is probably less common in Korea than in the United States.

There are, however, some complications involved in the Korean age-recording system. First, according to both the Koreans and the Chinese, a child is one year old at the time of birth (implying that the nine-month gestation period is one year of life). Furthermore, age in Korea is not reckoned from the individual's last birthday, but from the New Year (January 1). Thus, if a child is born on January 1, 1970, he will be considered two years old on January 1, 1971, exactly one year after birth. Therefore, if one simply asks how old a person is, the information obtained will be substantially different from the age in completed years at last birthday. In the extreme case, a child born on December 31, 1969, would be two years old on January 1, 1970 (the child is one day

old in age in completed years). A further complication in calculating age statistics with a lunar calendar is that the length of the year varies depending on whether it is a normal or a leap year. A normal lunar year has 12 months consisting of 354 days. The lunar calendar is kept in phase with the evolution of solar years by the insertion at irregular intervals of a leap year with an additional lunar month. If vital events such as births and deaths are evenly distributed over time, lunar leap years contain 13/12 as many events as normal years, or 8.33 percent more events. One leap year is usually followed by two normal years.

During the colonial period, census enumerators canvassed households and collected dates of birth, virtually all of which were expressed according to the lunar calendar. Ages were then derived from these birth dates. With proper conversion and adjustments, sufficiently accurate age distributions from all five colonial censuses can be obtained, and from these both the birth and death rates can be estimated. Yun-Shik Chang and Tai-Hwan Kwon have used these census data to provide plausible estimates of fertility and mortality for these periods (Chang, 1966; Kwon, 1977).

The situation became more complex after the war because of the gradual shift to the Western calendar. There are no data available on the changing proportion of the population reporting their birth dates using the Western calendar.

The Republic of Korea was established in the south in 1948, and from that time to the present the government has conducted seven censuses (in 1949, 1955, 1960, 1966, 1970, 1975, and 1980). The returns of the 1949 census were totally destroyed during the Korean War, leaving only a limited set of data on population (unfortunately, a detailed age-sex distribution is not available). The 1955 census was the first complete enumeration of the population after the Korean War. The single-year age distribution is available for geographic and administrative divisions of the country; in addition, marital status, employment and industry, occupation, and education cross-classified by age and sex are available for different areal subdivisions, as are data on refugee status from the North.

A comparison of the data from the 1955 and 1960 censuses reveals that the former considerably underenumerated the population (Cho, 1971). The National Bureau of Statistics at the time was not equipped with

the technical or financial resources to execute a high-quality census. In 1960, a major effort was made to conduct a large-scale census. Foreign technical assistance was enlisted. Many aspects of the census operation were modernized: pretests, postenumeration surveys, and modern data processing equipment were introduced; the quality of the operation improved substantially over the previous censuses, and the enumeration was more complete. The 1960 census for the first time incorporated items on age at first marriage and children ever born, items which subsequent censuses have continued to carry.

Unfortunately, however, foreign technical input in the design of the 1960 census resulted in a major technical blunder. Instead of following the well-established practice of computing age from birth dates, the foreign advisors introduced the U.S. census question simply asking the age of each person. The result, revealed by the postenumeration survey, was that over 75 percent of the population indicated age according to the lunar system. This left a negligible number in the age category under one year, and redistributed the numbers in the other categories. Various efforts have been made to convert the lunar age into age in completed years, but none has so far produced satisfactory results for refined demographic analysis.

Because of budgetary problems in 1965, no census was conducted in that year, but a simplified census was conducted in 1966. Proper caution was used in the section dealing with age determination. For the first time in the history of the Korean census, respondents were given the choice of indicating their birth dates by either the lunar or the Western calendar. In addition, respondents could indicate their "animal" of the 12-year zodiac for their birth year. The coding staff at the central office, using a conversion table, then computed the exact age in completed years. In addition to asking for children ever born, the 1966 census asked for the first time the number of children surviving. According to Cho (1971), the 1966 census was one of the better censuses in recent decades.

Similar census procedures were repeated for the 1970, 1975, and, most recently, 1980 censuses. In Korea, the data from these censuses serve as the principal basis for measuring and analyzing fertility and mortality in the absence of complete and reliable vital statistics. These data are amenable to refined demographic procedures that can help detect and measure changes in fertility and

mortality levels and age distribution over time. The existence of six census counts of the population in 25 years enhances the detection of errors, especially in age distributions, through demographic analysis; experience with other populations has shown that if the same enumeration procedures are used, similar patterns of overstatement and understatement of numbers at different ages will occur over consecutive censuses (Coale, 1955; Coale and Zelnick, 1963; Coale et al., 1979).

Surveys

Specialized population surveys were not conducted in Korea until the 1960s. With the introduction of family planning in 1960, and the beginning of the national program in 1962, the need for statistical information on attitudes toward and knowledge and use of family planning greatly increased. The earliest family planning survey was begun in 1961 in Koyang by the Family Planning and Population Center of Yonsei University (see Yang et al., 1965); in 1964, an interesting study of differential fertility was conducted in the town of Ichon (see H.-Y. Lee, 1965). Both of these surveys covered only small areas of the country. The first National Survey on Family Planning was conducted in 1965. Since then, nationwide surveys have been conducted every year or two (a partial listing appears in Table 5). These national surveys have been characterized by large (generally 4,000 to 8,000) samples of currently or ever-married women in their childbearing years. Their scope has included questions on cumulative fertility; complete pregnancy histories; family planning knowledge, attitudes, and practices; and specific experience with IUDs, oral pills, and abortion. Several contained questions that followed up on earlier surveys.

As a part of the 1966 census evaluation program, a postenumeration survey (PES) was planned by the Bureau of Statistics. To meet the growing need for demographic statistics, the scope of this survey was expanded to include questions designed to estimate not only current levels of fertility and mortality, attitudes on ideal family size, and the practice of contraception, but also population movement and migration. For this reason, the 1966 PES is also called the 1966 Special Demographic Survey. Extensive tabulations from this survey are available in Choe and Park (1969). Beginning in 1972,

TABLE 5 National Fertility Surveys, 1965-78: Republic of Korea

Year	Survey	Sample
1965	National Survey on Family Planning	4,000 currently married women aged 15-44
1966	National Survey on Family Planning	5,000 currently married women aged 15-44
1967	National Family Planning KAP Survey	5,000 ever-married women aged 15-49
1968	National Family Planning and Fertility Survey	7,477 ever-married women aged 15-49
1971	National Fertility-Abortion Survey	6,000 ever-married women aged 15-49
1973	National Family Planning KAP and Fertility Survey	2,400 ever-married women aged 15-49
1974	Korean National Fertility Survey (WFS)	5,417 ever-married women aged 15-49
1976	Korean National Fertility and Family Planning Evaluation Survey	6,000 ever-married women aged 15-49
1978	National Family Planning KAP Survey	8,000 ever-married women aged 15-49

Note: List is not exhaustive.

the Bureau of Statistics began conducting quarterly the Current Demographic Survey (CDS) covering a sample of about 22,000 households. The purpose of this survey is to estimate the number of births, deaths, and cases of migration; in its earlier years, it generally underestimated births and deaths. In 1974, the Bureau of Statistics conducted a major employment survey covering about 130,000 households. The principal objective was to provide various statistics on employment and the economically active population, using the labor utilization approach. The survey also contained some questions that can be used to derive basic demographic measures. In 1978, another major project on evaluation of vital statistics began in which the vital events enumerated by the CDS were matched with the vital events registered in the same survey areas. This project has been producing very useful results. Because of these efforts at the Bureau of Statistics, the CDSs in recent

years have improved substantially and have become an important source of vital statistics.

In 1979, the Korean Institute for Family Planning conducted a survey on contraceptive prevalence designed to assess the impact of the national family planning program (K.S. Koh et al., 1980b). The sample of 20,000 households was large enough to provide provincial-level data on contraceptive prevalence, fertility, and use-effectiveness. The Korean Institute for Research in the Behavioral Sciences conducted two surveys of the Value of Children (VOC), which also included information on fertility and family planning (Lee and Kim, 1979). A small pilot study with 378 respondents was completed in 1973; in 1976, a larger national sample of 2,050 married women and men was conducted which covered the entire country except for the province of Cheju Island. Cheju Island is, however, the geographical focus for an intensive study of fertility and family planning entitled the Korean Population Policy and Program Evaluation Study (C.B. Park et al., 1980). From 1975 to 1981, the study was jointly conducted by the East-West Population Institute, Korea's National Bureau of Statistics, and Dong-A University. This project has completed two large-scale benchmark surveys on Cheju's population of about 400,000, conducted simultaneously with the 1975 and 1980 censuses. In addition, one prevalence survey using only a small sample was conducted in 1978.

In conclusion, although Korea's registration of vital statistics has been incomplete and deficient, the country has in recent years developed other types of demographic statistics, such as census and survey data, from which both direct and indirect measurements of fertility can be made. As a result, there are now more than enough data to make analysis of fertility and family planning behavior possible; in fact, in some ways there may be more data than can be adequately analyzed.

CHAPTER 2

FERTILITY LEVELS AND TRENDS

This chapter presents estimates of fertility levels and trends during the last two decades and examines fertility changes; it also briefly discusses natural fertility and some of the factors influencing it. As suggested in Chapter 1, Korea's registration of vital events has been incomplete and insufficiently reliable for most of the period of interest; measurement of fertility must therefore be based on census or survey data. Recent population censuses conducted at fairly regular five-year intervals provide an extremely useful data base for indirect fertility and mortality estimation.

Application of the own-children method to the censuses of 1966, 1970, 1975, and 1980 has allowed the estimation of fertility for a period of nearly three decades, with multiple estimates for the years 1956-75. This method, when applied to a particular census, generates fertility estimates for each of the 15 preceding years; thus, when applied to censuses taken at five-year intervals, it produces more than one set of estimates for the overlapping periods. This is extremely important because these sets of fertility estimates for the same periods, derived from different censuses and subject to different biases, are largely independent and thus serve as a check on one another. The basic elements of the estimation method are outlined below.

The essence of the estimating procedure is reconstruction of the fertility experience of the women enumerated in a survey or census for the preceding period. Retrospective fertility estimates are usually made for the single-year cohorts of women aged 15-59 at the time of enumeration. By simply interpolating these estimates, and by translating the woman's age at the time of the census to that at the reference period, one can derive

the conventional period measures of age-specific fertility. The principal demographic adjustments needed are allowances for (a) mortality of children and their mothers, and (b) children not living with their mothers.

Applying this method, for most practical purposes, does not require that special questions be added to normal census schedules. All that is needed are simple tabulations of young children by the single-year age of the child and mother; these tabulations can be based on census or survey data on age and relationship to head of household. Because such information is usually coded as a part of regular census data processing, the work required to produce a basic tabulation of children simply entails locating the mother of the own children and transcribing the age of each child and mother. Other characteristics of the mother and father may be included for more detailed studies of differential fertility.

Since the own-children estimation of fertility involves reverse projection, estimation of mortality is an intrinsic part of the procedure. Census data on children ever born and children surviving, if sufficiently accurate, can be used to provide internally consistent adjustment factors for mortality of children. The own-children procedures were developed to estimate current fertility solely from census data without having to rely on independent mortality estimates from noncensus sources. The Brass procedure of estimating infant and childhood mortality from the proportion dead among children ever born recorded in censuses leads to an apparent underestimation; hence, for the present analysis, mortality estimates derived from the Survey of Fertility and Abortion were accepted and served as the basis for adjustments for later periods.

When census data are used, an additional adjustment must be made for the undercount of children and women; detailed discussion of the methodology necessary to make this adjustment is presented in other publications (Cho, 1973; Cho and Feeney, 1978; Cho and Retherford, 1978). Own-children fertility estimates cannot be more accurate than the census or survey data on which they are based. The most important requirement is the accuracy of age reporting for young children. Because of Korea's accurate age reporting, the own-children technique is particularly appropriate here. Although the resultant estimates from data from different sources are not perfectly consistent, they do provide an adequate basis for measuring and analyzing fertility levels and trends.

FERTILITY LEVELS AND TRENDS

Table 6 presents standard measures of fertility: the crude birth rate (CBR), or births per 1,000 population; the general fertility rate (GFR), or births per 1,000 women aged 15-49; and the total fertility rate (TFR), the number of children that would be born per woman reaching age 50 if women were subject to the age-specific fertility rates of the year in question.

Fertility estimates for the period 1955-75 presented in this table are from the National Academy of Sciences, Committee on Population and Demography, report on Korea (Coale et al., 1980), which was built upon much prior analysis of own-children data from Korean censuses done by Cho and others at the East-West Population Institute. The estimates for the 1976-80 period are from collaborative research conducted by the Korean Bureau of Statistics and the East-West Population Institute.

As discussed earlier in this report, the decade 1945-55 may be characterized as a demographic "dark age" in South Korea: not only was vital registration inadequate, but the 1949 census records were also destroyed in the course of the Korean War. The birth rate probably declined somewhat during the war, but the necessary data to support this inference are as yet unavailable. Contrary to the view of many demographers that a postwar baby boom began to take place in the South immediately after the cease-fire in 1953, it may be hypothesized that the lower birth rate continued until 1957, when most of the soldiers returned from the front. It should be remembered that, after the cease-fire in 1953, the South Korean army sent more of its own troops to the front to compensate for the withdrawal of United Nations and American forces. Officially, no members of the armed forces were discharged until 1957, although there were brief periods of leave for individuals after the cease-fire. This meant that normal family life for a large number of men in their twenties and thirties was disrupted from 1950 to 1957. Estimates of the fertility of this period are currently being derived from 1960, 1966, and 1970 census data.

Table 6 shows that there was an increase in fertility during the late 1950s, reaching the highest level around 1960 with a TFR of almost 6. This is equivalent to the level observed during the colonial period 1925-45. After 1960, a dramatic decline took place that continued until 1967, followed by a slackening until 1972. Another sharp decline is indicated for the period 1972-75. Between

TABLE 6 Summary Indices of Fertility: Republic of Korea

Year	CBR[a]	GFR[b]	TFR[c]	SMGFR[d]	MAC[e]
1955	39.5	164	5.46[f]		
1956	38.2	160	5.33[f]		
1957	38.4	162	5.40		
1958	41.9	178	5.94		
1959	41.8	179	5.93		
1960	42.1	182	5.98	251	30.5
1961	39.6	172	5.62		
1962	38.1	166	5.41		
1963	37.6	165	5.35		
1964	34.0	150	4.86		
1965	32.2	142	4.61		
1966	31.9	141	4.59	198	30.2
1967	30.3	134	4.34		
1968	31.2	137	4.42		
1969	30.8	134	4.39		
1970	29.8	129	4.24	185	29.8
1971	29.8	128	4.26		
1972	29.3	124	4.18		
1973	27.3	114	3.86		
1974	25.9	107	3.62		
1975	22.8	92	3.14	154	28.7
1976	23.1	90	3.1		
1977	22.6	87	3.0		
1978	21.8	83	2.8		
1979	23.1	87	2.9		
1980	22.4	84	2.7	151	27.4

Note: Fertility estimates for the last five years are based on unpublished own-children data from the 1980 census.

[a]The crude birth rate is calculated as the general fertility rate times the quantity (mid-year female population 15-49/mid-year total population) taken from uncorrected census data.

[b]GFR = (2,075 x female births)/female population 15-49.

[c]Calculation of TFRs is based on reported own-children schedules (see Coale et al., 1980).

[d]SMGFR denotes the standardized marital general fertility rate (calculated as $\Sigma P_x^{ms} \times F_x^m$ where P_x^{ms} is the proportion aged x to x + 5 of married women aged 15-49 in a standard population, taken here as the 1975 census populations, F_x^m is the observed age-specific marital birth rate in this same age group, and the summation ranges over ages 15-49). Values of SMGFR are taken from Retherford and Cho (1981).

[e]MAC is the mean age at childbearing calculated from the age-specific birth rates. Values of MAC are taken from Coale et al. (1980:3).

[f]TFRs for 1955 and 1956 estimated from trend in GFRs 1955-57.

1975 and 1980, the fertility level continued to drop but at a much slower pace, reaching a TFR of 2.7 and a CBR of 22 in 1980.

In Figure 1, the TFRs from 1960 to 1974 are compared with two sets of fertility estimates based on data from the Korean National Fertility Survey (KNFS) of 1974: own-children estimates from the household data, and estimates obtained from pregnancy histories collected in the survey. On the whole, the agreement is quite good, except for the somewhat higher levels of fertility from 1968 to 1972 indicated by the survey. Because of problems associated with the limited sample size and

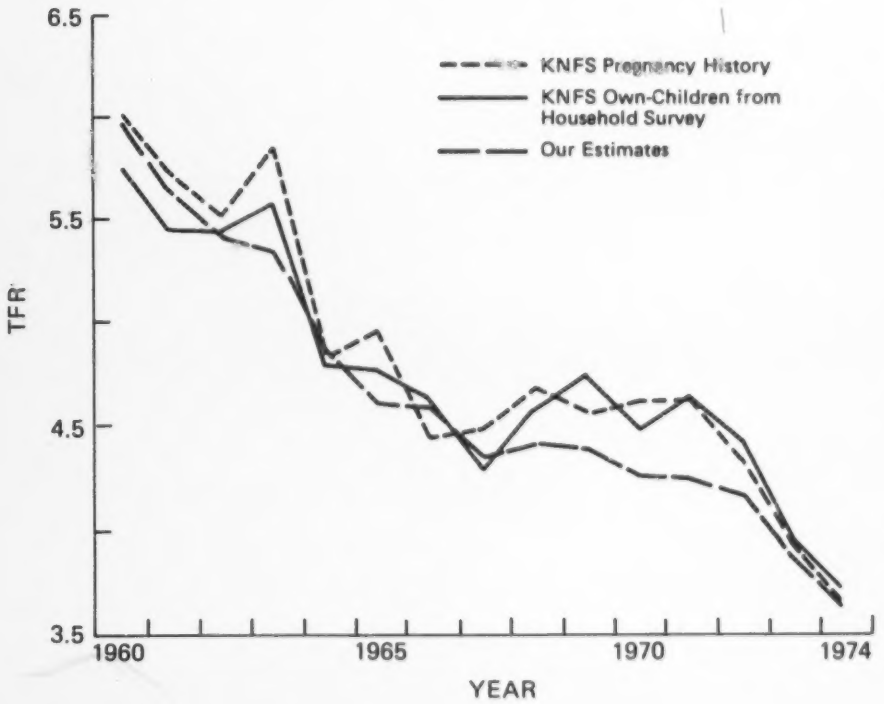


FIGURE 1 Estimated Total Fertility Rates, 1960-74: Republic of Korea

Note: KNFS pregnancy history and own-children tabulations are based on unpublished data from the Korean National Fertility Survey. Our estimates are adjusted census-based own-children estimates.

Source: Coale et al. (1980:6).

possible bias in the survey, the census estimates seem to be more robust. The most precise corroboration of the own-children fertility estimates is the validation of the average level and the average age pattern of fertility with estimates based on registered births adjusted for incomplete registration. As shown in Figure 2, the average age-specific fertility schedules for 1971-75 from these two independent sources are virtually identical. Because of the accurate age reporting in the Korean

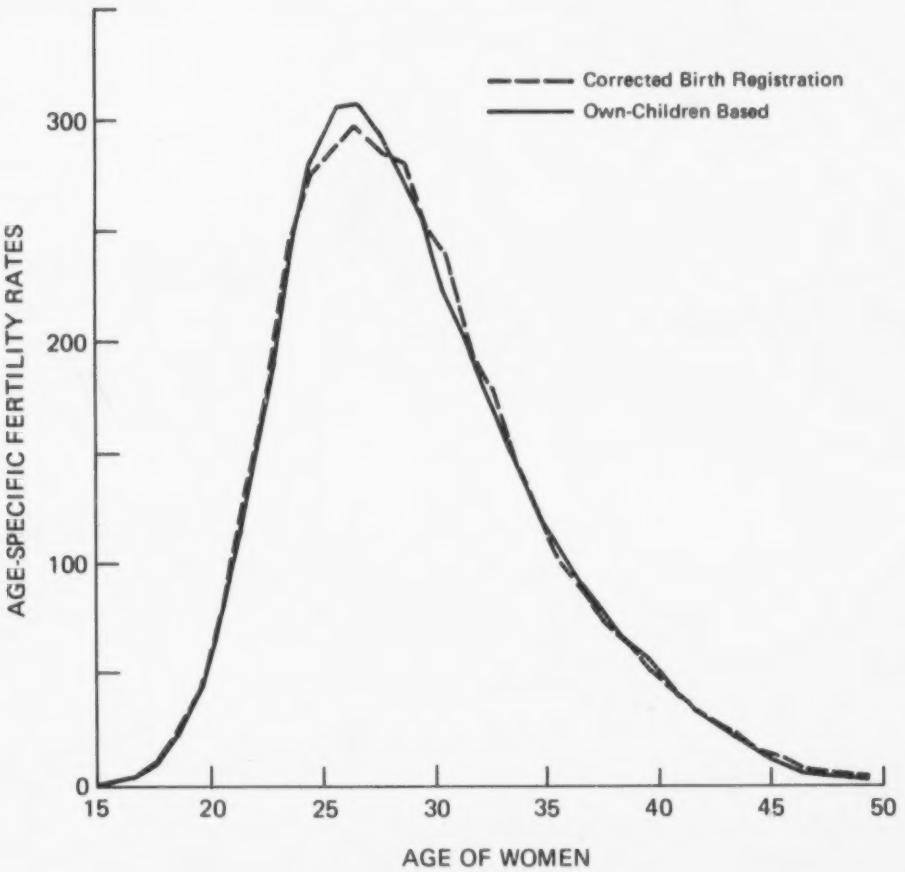


FIGURE 2 Age-Specific Fertility Rates (per 1,000 women), 1971-75: Republic of Korea

Note: Calculated from corrected birth registration and from own-children estimates.

Source: Coale et al. (1980:4)

censuses, the indication of a peak total fertility rate in 1960 and subsequent sharp decline can be accepted as genuine; these patterns are attested to by the differences in the number of children at the appropriate ages found in the censuses of 1966, 1970, and 1975. The summary of fertility rates presented in Table 6 and the changing age patterns of fertility in Table 7 are confirmed by estimates from independent sources.

From 1960, when fertility was at its highest, to 1980, the CBR, the TFR, and the GFR each fell by about 50 percent. The standardized marital general fertility rate (SMGFR), which effectively substracts out the effects of rising age at marriage, fell somewhat less drastically, by slightly less than 40 percent. The mean age at childbearing fell by more than three years during the

TABLE 7 Age-Specific Birth Rates, 1960-80: Republic of Korea

Year	15-19	20-24	25-29	30-34	35-39	40-44	45-49
All Women							
1960	35	249	323	273	204	96	16
1966	19	193	290	207	131	61	17
1970	13	174	298	207	111	43	8
1975	12	153	256	131	55	18	3
1980	5	130	264	111	31	7	1
Currently Married Women							
1960	460	378	347	298	232	117	22
1966	500	405	323	220	147	74	23
1970	460	411	337	219	121	51	10
1975	460	411	295	139	59	20	4
1980	[a]	350	304	118	33	8	1

Note: Age-specific birth rates for all women for 1960, 1966, 1970, and 1975 are taken from Coale et al. (1980:3) and are consistent, to within rounding errors, with the TFRs in Table 2.1; birth rates for married women for the same years were estimated by dividing age-specific birth rates for all women by corresponding age-specific proportions currently married. Rates for the age group 15-19 for currently married women are accurate only to two significant figures and are thus rounded to the nearest multiple of ten. Rates for both all women and currently married women for 1980 are preliminary own-children estimates calculated from the 1980 census.

[a]The estimate for currently married women aged 15-19 in 1980 is based on too small a number of women to provide a reliable figure and, hence, it is not shown in the table.

same period, as childbearing became more concentrated at younger reproductive ages. Table 7 provides further detail by showing trends in age-specific birth rates, both for all women and for currently married women. The rates for all women in the upper panel of the table show substantial declines at all ages, with proportionate declines that are especially large at the youngest and oldest ages. The picture is somewhat different in the second panel of the table, which shows rates for currently married women only. Except in the last intercensal period, birth rates for these women remained virtually constant below age 25. The trend in fertility at ages 25-29 has been gradual and somewhat erratic. Birth rates for currently married women age 30 and over fell steadily throughout the period, with declines of about 90 percent in the three oldest age groups.

The reason birth rates at ages 15-19 and 20-24 fell for all women but remained relatively constant for currently married women is that age-specific proportions married fell at these ages. The proportions currently married fell substantially at ages 15-19 and 20-24, and moderately at ages 25-29 (see Chapter 4 for a more detailed description of trends in proportions married). Proportions married rose at ages above 30, however, mainly because of a reduction in widowhood associated with mortality decline. The influence of mortality and widowhood is also apparent in the age gradient of proportions currently married, which declines with age after age 30 as adult male mortality increases to significant levels.

The decline of cohort fertility has been less dramatic than that of period fertility. For the cohorts of women who reached ages 45-49 in 1975, the peak childbearing years below age 30 occurred before 1960, when marital fertility was still very high and had not yet begun to fall. Thus their completed family size at ages 45-49, based on the census question on children ever born, does not show nearly as dramatic a decline as the TFR based on current age-specific birth rates. The slower decline of children ever born is illustrated in Table 8, which shows the average number of children ever born for all women and for ever-married women. The number of children ever born actually rose at many ages, particularly in rural areas, between 1960 and 1966, before falling in subsequent years. The declines after 1966 are moderate compared with those in current fertility measures shown earlier in Tables 6 and 7. One could say that the

TABLE 8 Mean Number of Children Ever Born, 1960-75: Republic of Korea

Age 1975	Whole Country				Urban				Rural			
		1960	1966	1970	1975	1960	1966	1970	1975	1960	1966	1970
All Women												
15-19	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
20-24	0.8	0.6	0.4	0.4	0.6	0.3	0.3	0.3	0.8	0.7	0.6	0.5
25-29	2.3	2.2	2.0	1.9	2.1	1.8	1.6	1.7	2.4	2.5	2.3	2.1
30-34	3.8	3.8	3.5	3.2	3.5	3.3	3.0	2.8	3.9	4.1	3.9	3.6
35-39	4.8	4.7	4.5	4.1	4.4	4.1	3.9	3.6	5.0	5.0	5.0	4.6
40-44	5.4	5.5	5.3	4.8	5.0	4.9	4.6	4.2	5.6	5.8	5.7	5.2
45-49	5.5	6.1	5.6	5.2	5.2	5.5	5.0	4.7	5.6	6.3	6.0	5.6
Ever-Married Women												
15-19	0.9	0.4	0.5	0.6	0.9	0.5	0.5	0.6	0.9	0.3	0.5	0.6
20-24	1.3	1.1	1.0	1.1	1.4	1.0	0.9	1.0	1.3	1.2	1.1	1.1
25-29	2.4	2.4	2.2	2.0	2.3	2.0	1.8	1.9	2.5	2.6	2.4	2.3
30-34	3.8	3.8	3.6	3.2	3.5	3.3	3.1	2.9	3.9	4.1	3.9	3.6
35-39	4.8	4.7	4.6	4.1	4.4	4.2	4.0	3.6	5.0	5.0	5.0	4.6
40-44	5.4	5.5	5.3	4.8	5.0	4.9	4.6	4.2	5.6	5.8	5.7	5.3
45-49	5.5	6.1	5.6	5.3	5.2	5.5	5.0	4.7	5.6	6.3	6.0	5.6

Source: Cho and Retherford (1981:4).

TABLE 9 Ever-Married Total Fertility Rates by Province, 1966-70 to 1976-80: Republic of Korea

Province	1966-70	1971-75	1976-80	Percent Decrease 1966-70 to 1976-80
Kyonggi Do	4,851	4,269	3,013	37.9
Kangwon Do	5,854	5,025	3,747	36.0
Chungchong Pukdo	5,838	5,006	3,643	37.6
Chungchong Namdo	5,753	5,224	3,731	35.1
Cholla Pukdo	6,374	5,647	3,971	37.7
Cholla Namdo	6,486	5,683	4,043	37.7
Kyongsang Pukdo	5,468	4,713	3,285	39.9
Kyongsang Namdo	5,638	4,891	3,473	38.4
Cheju Do	5,954	5,206	3,516	40.9

Source: Retherford et al. (1982).

children ever born figures show a great deal of inertia, since they embody, for older women, a good deal of high-fertility experience that occurred prior to the onset of the marital fertility decline in the 1960s.

LOCAL AREA FERTILITY DIFFERENTIALS

Table 9 shows recent estimates of ever married total fertility rates (EMTFRs) for all Korean provinces (excluding the metropolitan areas of Seoul and Pusan). In each of the three time periods shown, fertility differentials are apparent, with the lowest fertility province (Kyonggi Do) registering an EMTFR 25 percent below the highest fertility province (Cholla Namdo). These differentials appear to be related to the percentage of the population in each province living in rural areas (Retherford et al., 1982). The fertility declines over the ten-year period have been of the same magnitude in every province. It is possible to examine areal fertility trends in more detail by looking at county level data. Figure 3 shows the Coale index of marital fertility (I_g) for all counties in 1960 and Figure 4 shows the extent of the decline in I_g between 1960 and 1970. The lowest fertility in 1960 was found in the urban centers, particularly in the metropolitan areas of Seoul in the north and Pusan in the south. High fertility was clustered in counties situated away from the major urban centers and in the mountainous interior section of the country. Counties with an intermediate

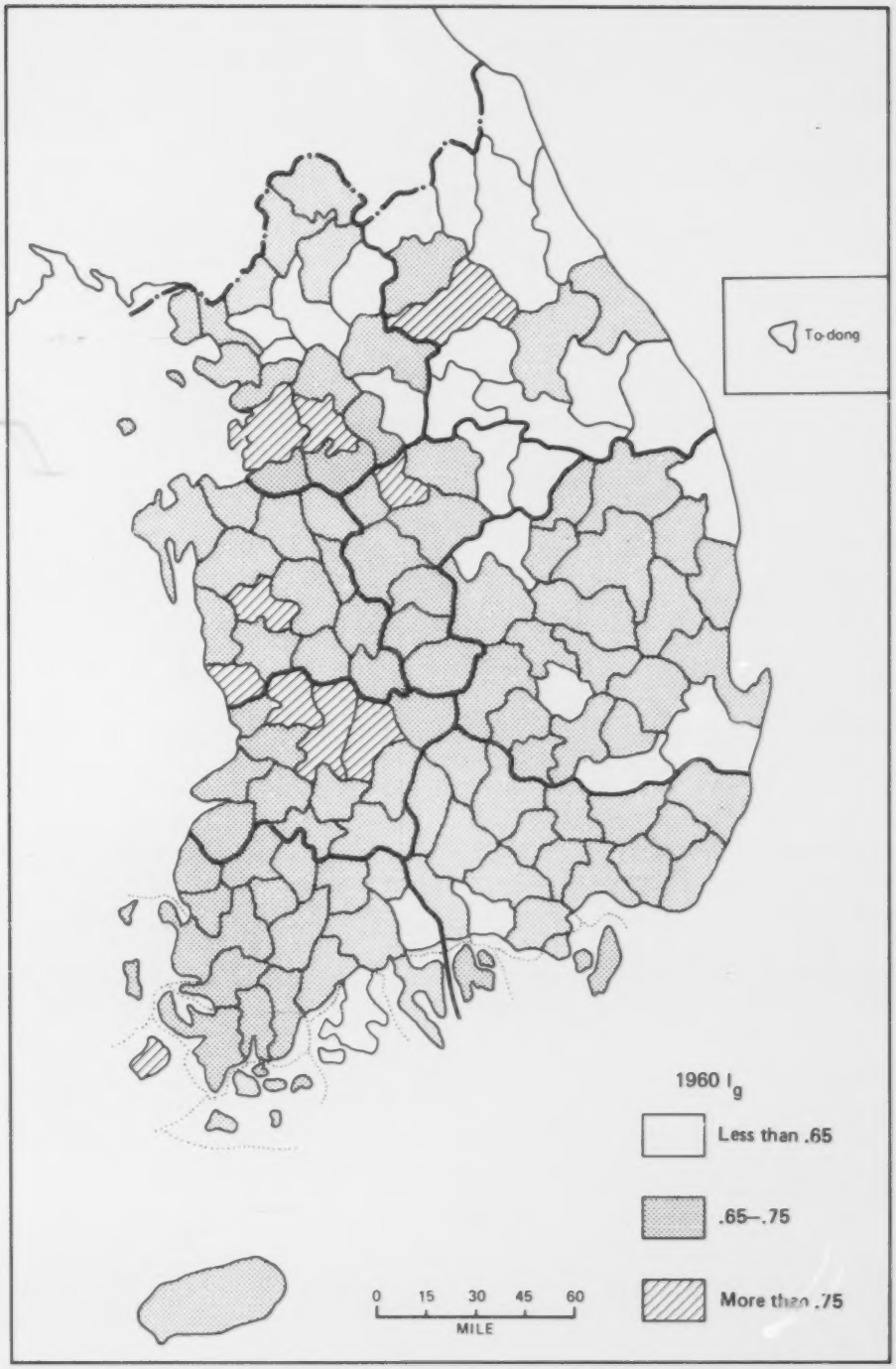


FIGURE 3 Coale's Index of Marital Fertility (I_g) for Counties, 1960: Republic of Korea

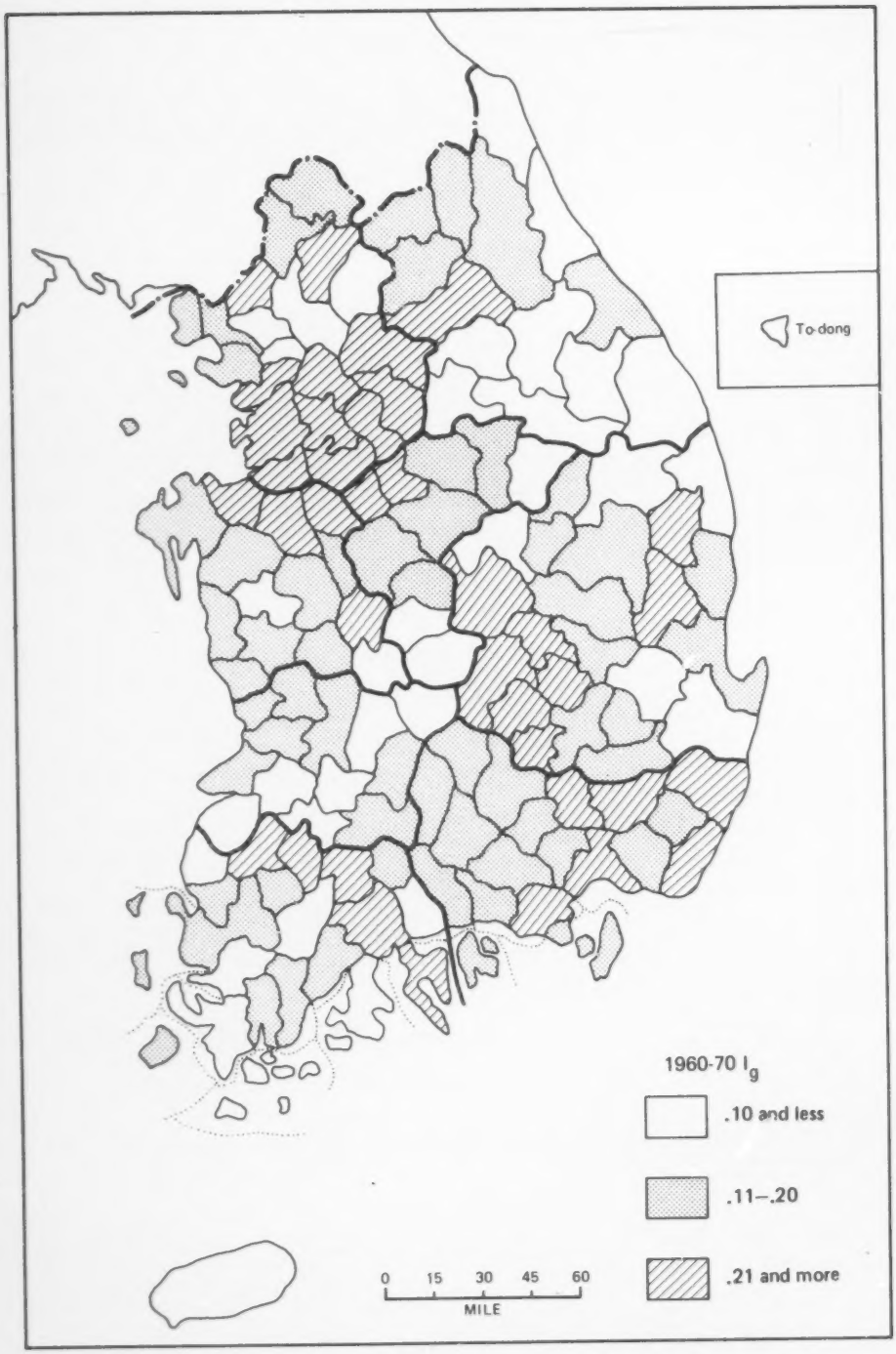


FIGURE 4 Decrease in Coale's Index of Marital Fertility (I_g) for Counties, 1960-70: Republic of Korea

level of fertility were found along the coast and near major transportation and communication lines (Retherford et al., 1982).

A majority of counties had a substantial reduction in fertility between 1960 and 1970, with the largest declines taking place in the major metropolitan areas of Seoul, Pusan, and Taegu. Nevertheless, every province had some areas that experienced little or no fertility decline. Counties with only slight fertility declines were largely in the least modernized part of the country along the east coast and in the rural areas of the less-developed southwestern provinces (Cho and Perry, 1979).

DEMOGRAPHIC ANALYSIS OF FERTILITY DECLINE

The import of the detailed tabulations of total fertility rates, age-specific birth rates, and age-specific proportions married presented above can be analyzed more concisely by decomposing the change in the TFR into its components. The particular decomposition methodology used here has been described earlier by Cho and Retherford (1981), Retherford and Ogawa (1978), and Retherford and Cho (1981).

Table 10 shows decompositions that break down the change in the TFR into two principal components: changes in population composition by marital status and changes in marital fertility. Each of these two principal components is in turn broken down by age. The total change in the TFR, as computed from Table 6, is shown in parentheses at the lower right of each of the four panels in the table. The percent contribution to change is given in the body of each panel, with 100 percent corresponding to the total change in TFR shown in parentheses.

It is evident from Table 10 that the decline in marital fertility after age 30 accounts for most of the change in the TFR. In fact, for 1966-70, a rise in marital fertility at ages below 30 acted to increase the TFR. The contribution of changes in proportions married was also substantial in the 1960s, but relatively small in 1970-75. Decreases in proportions married at ages below 30 acted to reduce the TFR, while increases in proportions married at ages above 30 acted in the opposite direction during all three periods. The preponderance of marital fertility contributions to the decline in the TFR is consistent with the observation

TABLE 10 Simple Percent Decomposition of the Change in the Total Fertility Rate: Republic of Korea

Period and Age	Marital Status	Marital Fertility	Total
1960-66			
15-29	36.1	1.6	37.8
30-49	-3.1	65.4	62.2
Total	33.0	67.0	100.0
			(-1.39)
1966-70			
15-29	49.2	-22.6	26.6
30-49	-10.7	84.1	73.4
Total	38.5	61.5	100.0
			(-0.32)
1970-75			
15-29	11.9	16.4	28.3
30-49	-0.9	72.6	71.7
Total	11.0	89.0	100.0
			(-1.13)
1960-75			
15-29	27.6	5.2	32.7
30-49	-3.2	70.5	67.3
Total	24.4	75.6	100.0
			(-2.84)

Note: Because of rounding errors, rows and columns do not always add precisely to marginal totals. Numbers in parentheses in the lower right of each panel indicate change per woman in the TFR over the period indicated.

Source: Cho and Retherford (1981:43).

made above that age at marriage was already quite late by 1960 and increased only moderately after that time.

As explained in Retherford and Ogawa (1978), the decomposition method can be extended to more variables. Because the results depend on the order in which variables are introduced, some caution is necessary in interpreting the results. For Table 11, the variables entered, in order, were education, residence, marital status, and marital fertility. Education consists of three categories (none, some primary, more than primary); residence of two (urban and rural); and marital status of two (currently married and not currently married). As before, it was assumed that all births occur within marriage, an acceptable assumption in view of Korea's low rate of illegitimacy.

The education component represents the contribution to changes in the TFR from changes in the educational composition of the population; the residence component represents the contribution from changes in residence composition within education categories; the marital status component represents the contribution from changes in marital status composition within education-residence groups; and the fertility component represents the contribution from changes in education-residence-marital status-specific birth rates. Over the period 1960-66, during which the TRF fell substantially (by about 1.4 children per woman), changes in educational composition accounted for 28 percent of the change in the TFR, as shown in the first panel of Table 11. With education controlled, changes in residence composition did not account for much additional change. With both education and residence controlled, changes in marital status composition acted to increase the TFR by 7 percent, thus reversing the sign of the marital status contribution in Table 10 and braking the overall TFR decline. Declines in education-residence-marital status-specific fertility accounted for more than three-fourths, or 79 percent, of the TFR decline; this contribution was concentrated at ages above 30, where major declines in age-specific fertility occurred.

The pattern for 1966-70, shown in the second panel of Table 11, is somewhat similar to that for 1960-66, except that compositional contributions were proportionately more important relative to the fertility contribution; this is not surprising, since the TFR declined much less during the last four years than during the first six years of the decade. During 1966-70, changes in

TABLE 11 Elaborated Percent Decomposition of the Change in the Total Fertility Rate: Republic of Korea

Period and Age	Education	Residence	Marital Status	Marital Fertility	Total
1960-66					
15-29	14.1	1.1	-5.4	15.6	25.3
30-49	14.1	-0.8	-1.8	63.2	74.7
Total	28.1	0.3	-7.2	78.8	100.0
					(-1.38)
1966-70					
15-29	31.1	10.1	-6.9	-21.5	12.8
30-49	39.5	-2.5	-13.9	64.1	87.1
Total	70.5	7.6	-20.8	42.7	100.0
					(-0.34)
1970-75					
15-29	6.1	0.6	18.9	1.7	27.3
30-49	7.5	0.5	-0.7	65.5	72.7
Total	13.6	1.1	18.1	67.2	100.0
					(-1.05)
1960-75					
15-29	11.2	2.3	4.5	6.7	24.5
30-49	12.9	-0.2	-3.3	65.9	75.5
Total	24.0	2.1	1.3	72.6	100.0
					(-2.77)

Notes: Results are based on own-children fertility estimates derived from a 10-percent sample from the 1960 census, a 1-percent sample from the 1966 census, a 10-percent sample from the 1970 census, and a 5-percent sample from the 1975 census. Because of rounding errors, rows and columns do not always add precisely to marginal totals. Numbers in parentheses in the lower right of each panel indicate change per woman in the TFR over the period indicated. Base data for 1960 were adjusted for errors arising from the way the 1960 census question on age was asked.

Results in Tables 10 and 11 must be interpreted cautiously. The two tables are not strictly comparable, because they are based on slightly different input data. Moreover, the reader should be aware that the percent contributions in the decompositions are sensitive to data errors, especially when the total change in the TFR is small, as during 1966-70. This sensitivity is evident in the age marginals in the right-most column of Tables 10 and 11, which show substantial disagreement between the two tables; the disagreement stems from the above-mentioned differences in input data.

Source: Cho and Retherford (1981:44).

educational composition accounted for 71 percent of the change in the TFR. Again, with education controlled, changes in residence composition contributed little. Changes in marital status composition acted to increase the TFR by 21 percent, reflecting a continued increase in proportions married within education-residence groups. Declines in education-residence-marital status-specific fertility during this period accounted for less than half, or 43 percent, of the TFR decline.

The third panel of Table 11 shows a rather different picture for 1970-75. During this more recent period, the education contribution was only 14 percent. The residence contribution was again small. Changes in marital status composition within education-residence subgroups contributed to, rather than subtracted from, the overall TFR decline; indeed, the marital status contribution of 18 percent (note its concentration at ages below 30) exceeded the education contribution. The fertility contribution was about two-thirds of the total. The fourth panel shows a summary decomposition over the entire period 1960-75.

When residence is introduced before education, the contribution of changes in education composition and residence composition are about evenly split instead of concentrated on the education side; the other contributions are virtually unchanged. This alternative decomposition is discussed in more detail in Retherford and Cho (1981). In interpreting the decompositions in Tables 10 and 11, the reader should be aware that the percent contributions are sensitive to errors in the input data, especially when the total TFR change to be analyzed is small, as between 1966 and 1970; therefore, too much significance should not be attached to precise numerical values.

Earlier, in Table 7, it was shown that age-specific marital birth rates rose at younger ages and fell at older ages between 1960 and 1975. This finding is reflected in the decompositions in Tables 10 and 11. Analysis of child spacing data indicates that the rise in marital fertility at younger ages was associated with a substantial decline in the interval between marriage and first birth during the 1960s and the first half of the 1970s (Rindfuss et al., 1982). Consistent with these changes, estimates of birth rates by duration since first marriage indicate that birth rates rose dramatically at short durations and fell sharply at long durations over the same period (Cho and Retherford, 1978).

The above-mentioned child spacing data, obtained from several national fertility surveys in Korea, indicate that first, second, and third birth intervals decreased sharply during the latter half of the 1960s, and that higher birth intervals, which increased in the early 1960s and the early 1970s, tended to plateau during the late 1960s. These findings are consistent with the census-based fertility estimates in Table 6, which also indicate a slowdown in fertility decline during the late 1960s, and with the decompositions in Tables 10 and 11. This consistency indicates that the slowdown of fertility decline during the late 1960s was real and cannot be attributed to estimation error.

Why did marital fertility increase at younger ages and shorter marriage durations, and why did lower-order birth intervals get shorter? Rindfuss et al. (1982) have demonstrated that the answer is not improved fecundity associated with better nutrition, nor is it improved fecundity resulting from age at first marriage rising out of the teen years when fecundity is lower. A major reason appears to be, instead, that a rapidly increasing proportion of first births within marriage were conceived before marriage. This is evident from the upward trend in the proportion of first births that occur within the first six to nine months of marriage. The deteriorating fit of Coale-Trussell model fertility schedules to the Korean data at younger ages since 1965 (Coale et al., 1979) supports this finding. Rindfuss et al.'s findings suggest also that some of the explanation of shorter birth intervals after the first birth lies in shorter breastfeeding. They find, moreover, that birth intervals of a given order are shorter when most of the previous children have been girls rather than boys; thus boy preference may result in consciously weaning girls earlier in order to try to get a boy sooner, although it is also possible that some birth control is used for spacing purposes, and that less spacing control is used when there is a shortage of boys. It is perhaps more important that among the younger generation of couples in general, a greater emphasis is placed on contracting birth intervals to enable the couples, especially the wives, to pursue career options beyond childbearing and childrearing.

NATURAL FERTILITY

Although fecundity is high in Korea, natural fertility appears to be low relative to other countries. There are indications, however, that natural fertility has been increasing, possibly in response to a change in breastfeeding practices, discussed below. Since most demographic research in Korea deals with the post-1960 period, information on natural fertility is very rare. Only two sets of fertility estimates are known to exist for earlier time periods when it can be safely assumed that reproductive behavior was not affected by any deliberate attempt to control family size (Kwon, 1977; Y. Kim, 1966). Since these two sets of estimates are in close agreement, only Kwon's are shown in Table 12. The relatively constant TFR between 1925 and 1960 is a consequence of age-specific fertility rates that rapidly decreased at ages 15-19 (because of a rising age at marriage) and increased at ages 25-49 (see Figure 5). Age-specific marital fertility rates, on the other hand, increased steadily throughout this period, in spite of extreme political upheavals, social unrest, and economic deterioration; in the ten years following 1945-50, these rates increased nearly 20 percent.

More recent fertility data are confounded by differing degrees of contraceptive use, although some suggestive information is available from the 1965 Ichon survey, which is regarded as the only reliable data relevant to the analysis of natural fertility in Korea. The mean number of children ever born to currently married women in Ichon was 1.2 at ages 20-24, 2.7 at ages 25-29, 4.3 at ages 30-34, 5.9 at ages 35-39, and 6.7 at ages 40-44. These averages were somewhat higher than 1966 census data for middle-sized towns because the census was subject to a greater degree of underreporting. Although the proportion of women who reported ever using contraception was fairly high for women aged 25-39 in Ichon, most such use was both ineffective and of short duration. The first effective family planning method to be introduced into the area, the IUD, was not available until early 1965, when the survey was conducted; therefore, its use could not have had any effect on cumulative fertility at that time. It is reasonable to assume, then, that the level of fertility for women aged 30 and over is a fair reflection of natural fertility in that area. The average completed family size of fewer than seven live births is relatively low, especially considering the

TABLE 12 Selected Measures of Fertility, 1925-60: Korea

Measure	1925-30	1935-40	1945-50	1955-60
Crude Birth Rate	45	44	42	45
Total Fertility Rate	6.2	6.2	6.0	6.3
Age-Specific Fertility Rates				
15-19	189	158	96	38
20-24	324	323	305	308
25-29	269	281	292	335
30-34	214	225	234	270
35-39	153	161	167	194
40-44	74	80	83	96
45-49	14	15	15	18
Age-Specific Marital Fertility Rates[a]				
15-19	276	283	300	357
20-24	340	350	369	440
25-29	283	292	308	367
30-34	230	237	250	298
35-39	171	176	185	221
40-44	90	93	98	117
45-49	18	19	20	24

Note: Data for 1925-40 are for all Korea; data for subsequent years are for South Korea only.

[a]The changes in age-specific marital fertility rates over time are assumed to be equal for all age groups.

Source: Kwon (1977:125-139 and 346-353).

customs of early and universal marriage and the stability of Korean marriages. No fertility survey conducted in Korea since the mid-1960s has found any woman reporting more than 14 pregnancies or 12 live births. Therefore, even at its extreme, Korean natural fertility appears to be relatively low.

FECUNDITY

Data on fecundity are often unreliable; however, according to all available data on both reported fecundity

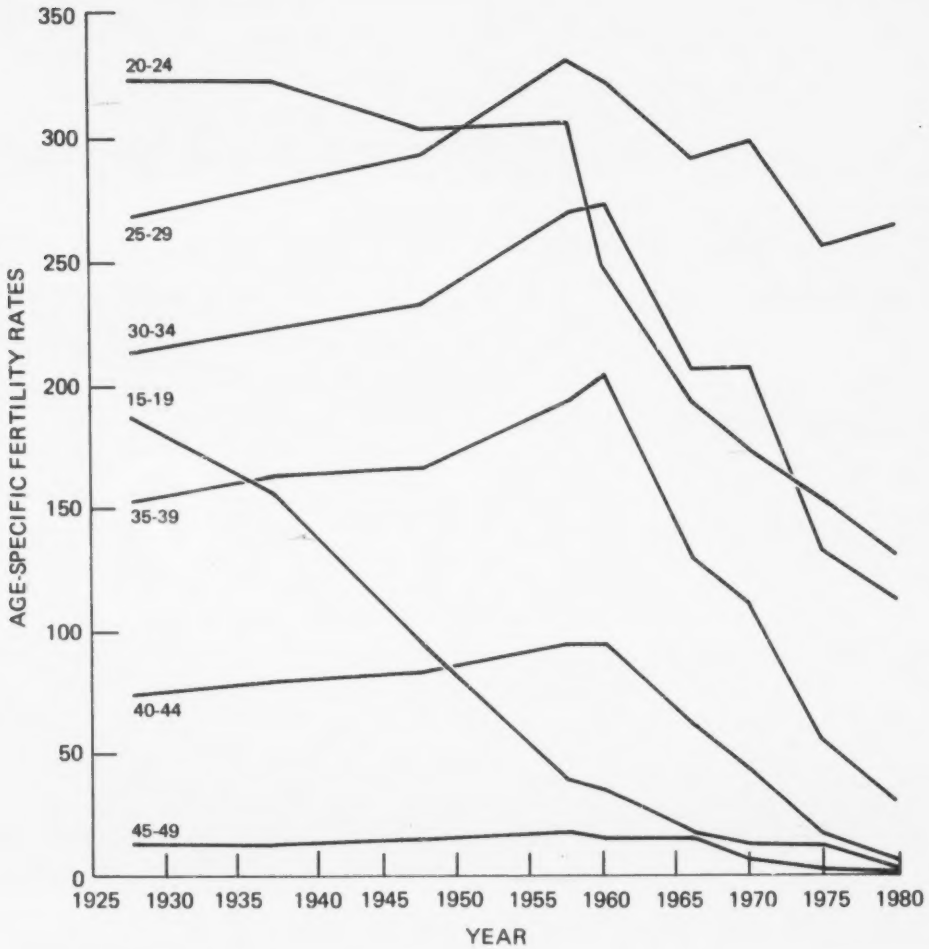


FIGURE 5 Age-Specific Fertility Rates, 1925-30 to 1980: Korea

impairments and the incidence of childlessness, the level of infecundity in Korea is quite low and has been decreasing over time in all age groups. Although early national surveys (1965-68) of married couples in which the wife was aged 15-44 found a nearly constant proportion of 86 to 88 percent who reported that they were fecund, this overall figure masks vast differences by age (see Table 13). In recent years, infecundity has rarely been reported by younger married women (under age 35). In 1976, the proportion reporting themselves to be fecund was still well above 90 percent in the 35-39 age

TABLE 13 Percentage of Couples Reported as Definitely Fecund, 1968-76: Republic of Korea

Age of Woman	Year of Survey						
	1968	1971[a]	1971[b]	1974[a]	1974[b]	1976[a]	1976[b]
25-29	97	99.0	98.9	98.0	97.8	99.4	99.3
30-34	92	96.8	96.2			98.8	98.5
35-39	83	93.0	87.5	84.6	83.9	94.5	93.7
40-44	66	55.3	48.7			85.1	84.2

[a]Those sterilized for contraceptive purposes are treated as fecund.
[b]Those sterilized for contraceptive purposes are proportionately distributed as fecund or sterile under the assumption that the proportion fecund among those who were sterilized is the same as among those who were not sterilized.

Sources: Koh and Smith (1970); Korean Institute for Family Planning (1973); B.T. Park et al. (1979); Korea, NBOS and KIFP (1977).

group and remained high, at about 85 percent, at ages 40-44 (although these reported figures are not likely to be a realistic appraisal of actual fecundity at these ages). Since the latter half of the 1960s, fecundity has increased in all age groups, but the gain has been most dramatic in the later reproductive ages.

This rapid increase in fecundity in the later reproductive ages has been attributed largely to a rising age at menopause, although this trend is not well documented. In the 1976 National Fertility and Family Planning Evaluation Survey, the proportion of women who had experienced menopause was reported to be 0.6 percent at ages 35-39, 3.5 percent at ages 40-44, and 27.9 percent at ages 45-49. At the other end of the spectrum, fecundity in the very early reproductive ages increased substantially between 1960 and 1980, as evidenced by the onset of menstruation at an earlier age in recent years.

The quality of the above data on fecundity impairments may be called into question for two reasons: (1) the self-reporting nature of the questions, and (2) the variable quality of the surveys in general. The basic results, however, can be corroborated with more reliable data on the incidence of childlessness in Korea. In less-developed countries, the incidence of childlessness can be used as a rough estimate of the incidence of

sterility, since voluntary childlessness is rare (Nag, 1980). According to the 1974 KNFS, "Involuntary childlessness, reflecting primary sterility, seems low in Korea: less than 3 percent of women in any duration of marriage category above 5 years have been without any children to date" (Korea, NBOS and KIFP, 1977:95). Furthermore, only 11 percent of women with no children reported any fecundity impairment. The 1974 survey indicated that only 1.3 percent of currently married women at the end of the childbearing years (ages 45-49) had not had a live birth, compared with 2.5 percent reported in the 1971 Fertility-Abortion Survey.

The proportion of couples with no live birth is even lower in the 35-44 age group, while it is somewhat higher at younger ages. In the earlier age groups, the probability of having married more recently is greater, so that many childless couples will eventually bear children. The older age groups are likely to include a larger proportion of remarried women with no children from their previous marriages; sterility of the husbands of remarried women is also likely to be high since the husbands are usually much older than their wives. Of course, it is possible that women without children are more likely to get divorced and not remarry (thereby artificially inflating the level of fecundity of currently married women), but reliable data on such a phenomenon are not available.

BREASTFEEDING

Breastfeeding is still nearly universal in Korea, although differentials in both its incidence and length are beginning to appear. Except when physiologically incapable, nearly all women still breastfeed their babies (B.T. Park et al., 1979). The 1974 KNFS found that 94 percent of women reported breastfeeding their babies in the last closed birth interval (Korea, NBOS and KIFP, 1977:127). These calculations were based on women with a last closed birth interval of at least 33 months. The mean length of breastfeeding was 19.2 months, with most breastfeeding for 1 to 2 years; only 16 percent breastfed for more than 2 years, and only 12 percent reported weaning their babies in less than 1 year.

Bottle feeding has now become popular among educated women in urban areas. The overall proportion breast-feeding is somewhat lower among city residents and better

educated women, especially younger women who have fewer than four children. These women are also more likely to breastfeed their children for shorter periods of time. Shorter durations of breastfeeding have resulted in shorter postpartum nonsusceptible periods, which, together with general health improvements, have led to substantially shorter interbirth intervals, at least for early parities.

Figure 6 shows the proportion of women who nursed their first child for various durations. Around 1950, almost half of these women were breastfeeding for more than 24 months. This proportion dropped to about one third of women in the early 1960s and to less than 20 percent by 1970. The proportion breastfeeding more than 18 months followed a similar pattern, falling by 43 percent between 1956 and 1970. Very little change can be detected, however, in the proportion breastfeeding more than 9 months, except for a slight decline since 1964. In the case of breastfeeding more than 1 year, there is a slightly greater decline in more recent years. Apparently, the abandonment of very long breastfeeding began quite some time ago, and recently, only a small proportion of women have continued very prolonged nursing, although the large majority of women continue to nurse their children for moderately long periods of 9 months or so.

Before 1960, when the practice of family planning and abortion was very limited, these changes in breastfeeding apparently contributed to a reduction in the frequency of long interbirth intervals, and consequently to the rise in marital fertility from 62 percent to nearly 90 percent of standard natural fertility, the average of ten schedules listed by Henry (Coale et al., 1979). The effect of breastfeeding on fertility in Korea is, however, still open to question. Between 1960 and 1970, Bongaarts (1978:123) noted that the total natural fertility rate increased as a result of a decline in lactation. However, this small increase was more than offset by substantial increases in the use of contraception and induced abortion and a decline in the proportions married. The KNFS data showed that women who wanted no more children breastfed significantly longer than women who wanted more children (Nemeth, 1981). The same survey found a strong positive association between the length of breastfeeding and the length of the last closed birth interval for women who did not use contraception (Korea, NBOS and KIFP, 1977); however, the

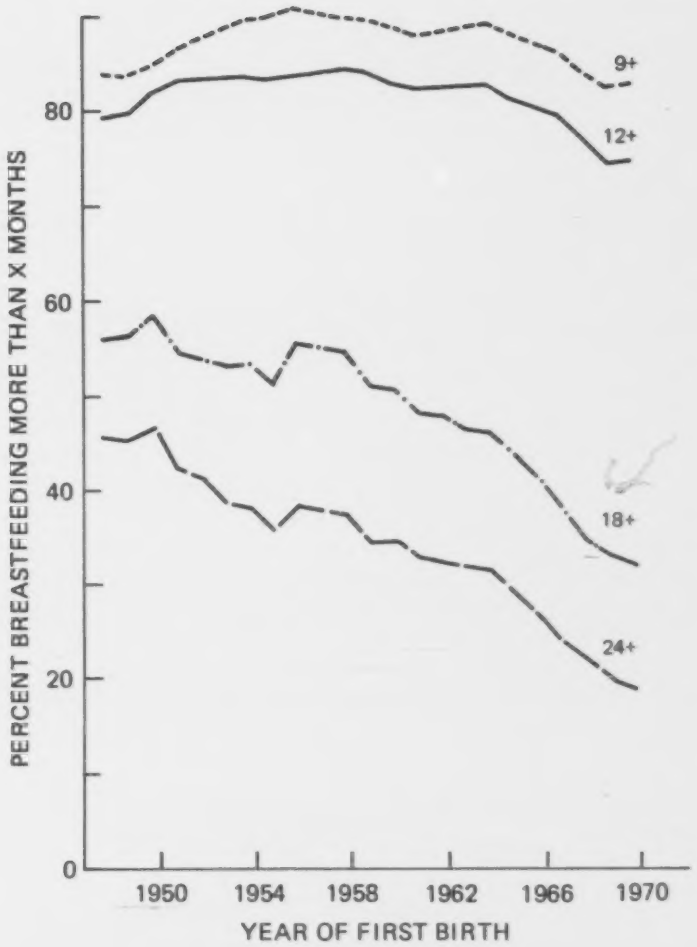


FIGURE 6 Percent of Women Who Breastfed for More Than 9, 12, 18, and 24 Months After First Birth, by Year of First Birth: Republic of Korea

Note: All values are five-year moving averages.

Source: Coale et al. (1979:20).

factors leading to that relationship are not entirely clear. Although there would appear to be some causal influence of breastfeeding on pregnancy, at least part of this influence is in the opposite direction since many women breastfeed their babies until they become

pregnant. In an earlier study in Ichon, the small differences between the average length of breastfeeding and the length of the interval between a birth and subsequent pregnancy for women in the older age groups were found to be due primarily to greater foetal wastage. Practically every woman in the Ichon survey area breastfed her children until the start of the next pregnancy, regardless of her age. In Korea today, if widespread breastfeeding practices have been one factor keeping fertility below its maximum level biologically, any changes in these practices will tend to work against further declines in fertility.

CHAPTER 3

SOCIOECONOMIC CONDITIONS AND FERTILITY

The previous two chapters dealt separately with rapidly changing economic and social conditions in Korea and the fertility transition. The present chapter examines the relationship between these changes. The methodology used encompasses several related approaches, including macro-, micro-, and community-level studies. The relatively large number of micro- and macro-level studies conducted in the last several years have shown clearly the impact of modernization and socioeconomic development on fertility levels in Korea: demand for children has been reduced by a decrease in their net utility (Cho et al., 1977); moreover, consumer aspirations have been raised by the variety of goods and recreational activities that are becoming available. This general rise in expectations, combined with a growing feeling of relative deprivation generated by rapid economic development and urbanization, has put growing pressure on large families (Kwon et al., 1975). While it is recognized that socioeconomic development in general can be instrumental in producing a fertility decline, it is more useful to examine the individual facets of that development. These include urbanization, declining infant and child mortality, rising educational attainment (especially for women) and educational aspirations for children, the changing status of women, increasing female labor force participation, a rise in consumer aspirations, and improved transportation and communications.

These various factors are discussed in relation to fertility in the subsections below. This is followed by a review of the mixed evidence on the fertility impact of community and ecological factors. Although some empirical studies have been unable to demonstrate this impact, the discussion below reviews a detailed anthropological study

and an areal analysis that found these factors to be of critical importance.

URBANIZATION AND MIGRATION

Since the Korean War, Korea has been transformed from a heavily rural, agricultural society to one in which the majority of the population lives in urban areas (see Chapter 1). Although this rapid rate of urbanization has proven to be an important factor in the country's fertility decline (Moon, 1972; Kwon et al., 1975; C.B. Park, 1978), it may prove to be less important in the future. Rural women currently have considerably higher fertility than urban women; however, rural fertility has declined at a slightly faster rate than urban fertility and remains higher only because it started at a much higher level. In 1960, the TFR for rural women was 6.6 compared with a rate of 4.5 among urban women (see Table 14); by 1975, urban total fertility had dropped by 39 percent to 2.8, while rural total fertility had declined by 44 percent to 3.7. However, these declines were not uniform over this period. From 1960 to 1966, total fertility in urban areas declined by 30 percent, compared with a decline of 17 percent in rural areas. During the next decade, however, rural fertility fell almost three times as rapidly as urban fertility (declining by 32.4 percent in rural areas and 11.8 percent in urban areas).

Although contraceptive use rates have been consistently higher in urban than in rural areas throughout the history of the Korean family planning program, the most recent national survey shows virtually no difference in use rates (Koh et al., 1980b). Differentials in ideal family size between urban and rural areas have remained nearly constant for at least the last fifteen years (Stoeckel, 1975; Cheong et al., 1979). In recent surveys, rural women in Korea say they want about one half child more on average than women in large cities, although they actually expect to have about one child more on the average (Cheong et al., 1979; B.T. Park et al., 1979).

Rapid urbanization affects both those born in cities and those who move to cities from rural areas, but the effect on the migrant can be particularly profound. In describing urbanism as a way of life, Wirth (1957) observed that it is characterized by secularization, secondary-group relationships, voluntary association, increased segmentation of roles, and poorly defined

TABLE 14 Own-Children Estimates of Total Fertility Rates per Woman, 1960, 1966, 1970, and 1975: Republic of Korea

Residence and Year	Education			
	None	Primary	More than Primary	Total
Whole Country				
1960	6.72	5.45	3.96	5.98
1966	5.79	4.56	2.92	4.60
1970	5.17	4.38	3.49	4.26
1975	3.80	3.51	2.77	3.21
Urban				
1960	5.27	4.51	3.53	4.50
1966	3.72	3.38	2.58	3.13
1970	3.84	3.80	3.36	3.58
1975	3.08	3.05	2.59	2.76
Rural				
1960	7.00	6.15	5.24	6.60
1966	6.23	5.30	3.99	5.50
1970	5.57	4.79	4.02	4.81
1975	4.10	3.85	3.35	3.72

Source: Retherford and Cho (1981).

social norms. For Korea, Moon (1972) noted that urban life is accompanied by a decline in primary relationships and traditional kinship values because the migrant is removed from the traditional milieu of the agricultural population. While it is generally true that migrants have a smaller number of children than nonmigrants,[1] it is not clear to what extent this can be attributed to urban adaptation. Ro and Ahn (1977) feel that urban exposure does tend to reduce fertility, but that migrants also possess certain attitudes and motivations that predispose them to having fewer children. B.S. Lee et

al. (1981) constructed an autoregressive fertility model to control for selectivity of migrants and to test for adaptation. They found that migrants from rural areas to Seoul would have 2.9 fewer children than comparable rural stayers, those moving to other large cities would have 1.9 fewer children, and those moving to small cities would have 1.2 fewer children. Concluding that adaptation to urban life is significant in explaining the reduced fertility of rural-urban migrants, the authors estimated that rural-urban migration was responsible for averting 2.6 million births during the decade 1965-75.

SOCIOECONOMIC STATUS

Although Cochrane (1979) has found that the traditional negative relationship between education and fertility is not as universal as previously thought, increases in education in Korea are without doubt one of the major causes of fertility decline (N.H. Cho et al., 1977; Moon, 1972). Fertility has been found to be negatively related to education (particularly wife's education) in both rural and urban areas and for all time periods for which data are available (S. Hong, 1978; Kwon et al., 1975; Cho and Retherford, 1981). This relationship generally holds for a variety of fertility-related variables (number of children ever born, TFR, ideal family size, and nonuse of contraception and abortion), even after controls are introduced for numerous other sociodemographic variables. However, this inverse relationship between education and fertility has shown some tendency to weaken over time, and there has been considerable convergence in contraceptive behavior between educational groups (Korea, NBOS and KIFP, 1977; Cho and Retherford, 1981). Own-children fertility estimates for 1960-1975 (Table 14) show that rapid fertility decline in both urban and rural areas started in all educational groups simultaneously. These estimates also confirm both the inverse relationship between education and fertility throughout this period and the convergence between educational groups over time.

This pattern is consistent with the transitional hypothesis of differential fertility (Cho et al., 1970:282-285), which states that a population in the early stage of its demographic transition begins to exhibit a sharp inverse relationship between fertility and educational attainment (as well as other components of social status). This relationship is the result of a

transformation of the traditional value of children as productive units to their new value as consumer goods. Since individuals of higher socioeconomic status are the first to adopt new life styles, their fertility begins to decline earlier than that of lower socioeconomic groups.

The KNFS reported that the TFR dropped monotonically from 4.8 for women with no schooling to 2.5 for women with a college education (Korea, NBOS and KIFP, 1977:91). Much of the educational differential, however, was due to differences in the proportion of women married at ages under 25. This is evidenced by the fact that the total marital fertility rate varied between only 5.3 and 4.4. Mason and Phananiramai (1981) used an elaborate economic-demographic model to examine marital fertility and found, quite surprisingly, that more education leads to higher marital fertility. Part of the explanation for this puzzling relationship is that more highly educated women of a given age have a shorter duration of marriage than those with less education. However, a significant positive relationship persisted even after controlling for marital duration. The authors do caution that women with higher education will not necessarily have higher completed fertility since they tend to marry later.

Although some of the impact of education on fertility is direct, there are also undoubtedly indirect effects through such intervening variables as educational aspirations for children, media exposure, female employment, breastfeeding, infant mortality, occupation, and income. Predictably, income does not appear to have much net effect on fertility (Mason and Phananiramai, 1981). Couples with higher income do express less dependence on their children for old age support, but the overall effect of income tends to wash out when other factors are introduced.

Occupation appears to have some impact on fertility, although its effect is also attenuated when controls are introduced. The KNFS found that, within education groups, women whose husbands worked in agriculture had the highest level of fertility (Korea, NBOS and KIFP, 1977). The same study found that professionals and managers were distinctive for their high level of contraceptive use, while farmers and manual laborers were distinctive for their low level of use. These findings would suggest that as Korea's economy continues its industrial transformation and Korean men and women shift to jobs with higher occupational prestige, continuing fertility decline will be favored.

FEMALE EMPLOYMENT

In the last two decades, there has been considerable improvement in the status of women in Korea, accompanied by an increasing propensity of women to join the labor force. Korean women also have a longer average work week (53.5 hours) than women in any other country in the world (according to a recent report of the International Labor Organization cited in the Honolulu Star-Bulletin, January 22, 1982). In a 1976 national survey, B.T. Park et al. (1979) found that the percentage of married women who had been employed before marriage decreased monotonically with age, from 44.5 percent for women under age 25 to 9.3 percent for women aged 45-49. Moreover, about 23 percent of women were working at the time of the survey (30 percent in large cities and 18 percent in rural areas). Although female labor force participation has been rising, it is not clear whether women's work per se has been partly responsible for Korea's fertility decline.

The KNFS found no clear pattern of association between women's work experience and either current contraceptive use or cumulative fertility (Korea, NBOS and KIFP, 1977; Koo, 1979). Data from the 1970 census indicate that employed women had higher fertility than nonemployed women in every age group (United Nations, ESCAP, 1975). However, in a more restricted sample of women aged 26-30 in 1970, Ro (1979) found that women's economic activity had the largest (negative) impact on the number of children ever born of any variable included in a multivariate model. In fact, women who were regularly employed had an average of .57 fewer children than those who were economically inactive, after controlling for education, literacy, migration status, occupation of household head, industry, and urban-rural residence.

As might be expected, the type of job seems to be more important in determining fertility than economic activity alone. Certain jobs are more compatible with raising children than others. Although S. Hong (1978) did not find much of a fertility differential between working and nonworking women, she found that women whose jobs were incompatible with housekeeping had much lower fertility than those whose jobs were compatible. Low fertility has also been found to be characteristic of women in professional and technical occupations and women with high opportunity costs of earnings (United Nations, ESCAP, 1975; S. Hong, 1979).

The mere act of working, therefore, seems unlikely to cause reduced fertility in a country where many jobs are entirely compatible with childrearing and alternatives to caring for children during the workday are readily available. However, the increasing nucleation of the family, the continuing evolution in the structure of job opportunities, and the changing status of women may all combine to facilitate a further reduction in fertility rates in the future.

INFANT AND CHILD MORTALITY

One measure of socioeconomic conditions in a country is the state of health of the population in general, and the level of mortality in particular. Since the Korean War, mortality rates have declined precipitously in Korea: the infant mortality rate declined from 100 to 122 in 1955-60 to 37 in 1978-79 (Korea, Bureau of Statistics, Economic Planning Board, 1980; Cho and Feeney, 1976). In the past, infant mortality appears to have had a substantial influence on fertility rates, although there are almost no empirical studies to support this link (S. Hong, 1978); both changing attitudes toward family size and the country's overall fertility decline have been attributed to the decline in infant and child mortality (Kwon and Lee, 1976; N.H. Cho et al., 1977).

However, mortality has now reached such a low level that it is evidently no longer a major factor in childbearing decisions. In 1976, N.H. Cho et al. (1977) reported that only 13.1 percent of married women mentioned worry about child mortality as a disadvantage of a small family. In the same year, the Value of Children study found that not a single respondent (out of more than 2,000) spontaneously mentioned mortality risks as a reason why it is undesirable to have only one child (Bulatao, 1979:87). C.B. Park et al. (1979:564) estimate that at this point in time, the complete elimination of infant mortality would lead to only a one point reduction in the crude birth rate. The authors conclude that "the effect of infant mortality may be of micro-level concern but may not have much impact on the macro-level."

The above discussion indicates that changing socioeconomic conditions in Korea can take much of the credit for precipitating the recent fertility decline. Rapid urbanization, increasing educational attainment (particularly for women), the increasing availability to women of

jobs that are incompatible with childrearing, and the drastic decline in infant and child mortality have all contributed to the fertility transition. While the first three factors may be expected to put continuing pressure on the birth rate in the future, infant mortality is now so low that further reductions are unlikely to have much impact on fertility.

COMMUNITY AND ECOLOGICAL FACTORS

There has been little research on the relationship between community factors and fertility behavior in Korea. Only four major studies are known to be available so far. The results of these studies seem to depend on the type of data and methodology used. Least successful in demonstrating an effect of community factors on fertility are studies that add community-level variables to individual records on survey data files. Aggregate-level analyses relating average areal fertility levels to other areal characteristics have met with some success. The type of research that has shown the strongest results is an anthropological study primarily based on field observation.

Cho and Perry (1979) conducted an areal analysis of the determinants of fertility in 140 rural counties in Korea. They found that both socioeconomic factors and IUD acceptance have a negative impact on marital fertility among rural women aged 30-44, but the effect of socioeconomic status is not discernible among younger women. Their study also demonstrated that IUD acceptance rates have a greater negative impact on fertility in areas with relatively low socioeconomic levels.

Using 1974 KNFS data, S.B. Lee et al. (1978b) examined the extent to which community differences in family planning practices are explained by community characteristics. They found that the differences were moderately associated with the aggregate socioeconomic levels of each village expressed as averages of the socioeconomic standings of individuals. The most important aggregate variables were almost identical to the variables that explained differences among individual couples. The relationship of community structure and environmental factors to the level of family planning practices in a community was found to be insignificant. S. Hong (1976:179), investigating the association between community development and the desired family size of

individuals in 53 villages in southeastern Korea, arrived at a similar conclusion,[2] but in her dismay at the results she stated the following:

> From my own personal experience, I am certain that the social environment affects individual behavior. In the research . . . , however, few effects are discernible. Perhaps the methodological and measurement suggestions just made (in the dissertation) will lead to improved studies of the community effects on individual behavior.

Such an improvement could be made by the adoption of a holistic approach based on intensive and prolonged field observation. The anthropological research of Han and others on "social, cultural, and ecological factors affecting population processes in Korea," which was carried out during a one-and-a-half-year period between 1975 and 1976 (Han and Kwon, 1981), is typical of this approach and provides many insights into the relationships between community factors and reproductive behavior. For comparative purposes, the research selected as its observation sites four ecologically and socioculturally distinctive communities in different parts of the country: a rice-farming village, a mountainous farming village, a fishing village, and a middle-sized town. The most important finding of this research is that ecological factors such as the type of subsistence economy, the pattern of labor participation, the seasonality of labor demand, and community mortality and health conditions are critical determinants of the marriage institution, the family system, and family-building behavior and attitudes, as described in more detail below.[3] The same kinds of relationships between socioeconomic background and individual fertility are confirmed as in other KAP (knowledge of, attitudes toward, and practice of contraception) types of surveys conducted in Korea; however, unlike other studies, this research discloses many striking features of community-level fertility differences and behavior.

When different types of communities are compared, no significant negative relationship is observed between the level of fertility and the average age at marriage. In the fishing village, the level of fertility was relatively low, while marriage took place at a comparatively young age; the reverse was true in the rice-farming village. Similar dissonance was seen between fertility behavior and attitudes: women in the fishing village revealed

very high family-size ideals, while their actual fertility was relatively low.

The pattern of seasonal variations in the level of births differed from one type of community to another. The mode of mate selection and meaning of marriage were distinctive in each type of community, even in the traditional setting. It is well documented that in traditional Korea, marriage was mostly arranged regardless of the opinion of those being married; though the consent of children was assumed, arranged marriage was both the preferred and dominant mode of mate selection, even in the early 1960s (J.S. Choi, 1966:438; Lee and Kwon, 1968). However, free marriage was common in the fishing village, which was most underdeveloped. Even in the case of an arranged marriage, the process of mate selection was entirely different in the farming and fishing villages: in the latter, there was hardly any significant family or community involvement in mate selection (unpublished research notes and Chun, 1977a). Marriage patterns in the town community were similar to those in the farming areas.

Patterns of fertility-related behavior therefore vary among the survey communities. The discussion that follows examines how different ecological or environmental factors have brought about these differentials.

Type of Subsistence Economy

As is obvious, fishing constitutes the major industry in the fishing village. In addition, upland farming and sea-plant cultivation form a substantial part of the subsistence economy of the area. Fishing is exclusively assigned to adult males, while women work in upland farming; during the winter, the whole family, including children, is engaged in sea-plant cultivation. The farming and mountainous villages rely entirely on rice cultivation and dry-field farming; economically, the two villages are quite similar. The people in the town community, who are no better off economically than farmers, are mostly employed in the service sector.

The relatively low level of fertility and large family-size ideal in the fishing village can be explained primarily by the type of subsistence economy. Traditional sea fishing on a small boat involves considerable risk. The close relationship between high mortality and large desired family size is already well established. More-

over, high mortality among adult males frequently causes the discontinuation of marriage for women. In addition, because boat fishing itself results in separation of the couple, abstinence is frequently observed during the fishing season. These factors have contributed to the comparatively low fertility in the community. Similarly, the high fertility in the farming villages can partly be explained by the low risk of dying involved in agriculture, the concurrent stability of marriage, and the infrequent practice of voluntary abstinence.

The high mortality of adult men of reproductive age appears to have profound implications for the marriage and family system of the fishing village. There is little social resistance against the remarriage of women in the area. The survey reveals that about 90 percent of currently married women are in their second or third marriage; the equivalent proportions in the other communities are less than 10 percent. In the fishing village, family life is highly unstable: concubinage, desertion of spouses by either side, and separation of the couple are very common. In contrast, the rice-farming village, which is also a kin (or clan) village, manifests very strong family solidarity and stability. The type of family system seems to be associated directly with the degree of family involvement in mate selection; so-called "free marriage" is found mostly in the fishing village and least in the farming village.

The major meanings or functions of marriage also vary in accordance with the ecological setting of an area. The primary concerns of married people in the farming village closely agree with the alleged traditional functions postulated by the neo-Confucian ideology, which emphasizes the succession of family name, family unity, filial piety, and so forth. These are of only secondary importance in the fishing village, where dependence in old age and personal security are primary concerns. In the fishing village, the right and duty of ancestor worship can even be traded among those who have no kinship relations at all (Chun, 1977a).

Thus it seems clear that the type of subsistence economy is closely linked with the level of fertility, the meaning and practice of marriage, and the family system of an area. However, the differences in desired family size cannot be properly explained in the same way; for this purpose, labor demand and the importance of child labor in the community economic system must be examined.

Demand for Labor

In the town community, the economic value of children is minimal, while in the fishing village, it is of much greater importance. In general, the economic value of children is partly determined by the extent of women's labor force participation in the survey communities: the value is greater when the need for women's labor force participation increases. This observation is generally valid where a traditional industry or economic system is dominant; however, the reverse may be true in a modern system where the major goal of women's economic activity is self-realization or ability and career development.

The research discloses that the proportion of women in any kind of economic activity is very minor in the town community. In contrast, in the fishing village, farming is almost exclusively assigned to women. Men rarely work on the farm or help with household jobs, even if they stay home idle, and children usually prepare supper for the family and clean the house; in other words, women's prescribed economic activity can only be properly performed if children are present. In the farming village, women's work outside the house is largely confined to dry-field farming, and rice farming is the duty of men under ordinary circumstances.[4] In these villages, children have little economic value, but also do not constitute much of an economic burden. Older sisters and brothers usually take care of younger ones, and if not, the community provides the necessary care.

Another important observation is that in the fishing village, sea farming during the winter, which is then the most important income source, is extremely labor-intensive; the amount of farming is determined, year by year, by the number of household members available. Children who have migrated to the city and are marginally employed there often return to the village to help their family during this season. No evidence of circular migration for work is seen in the other communities (Chun, 1977a).

Such demand for both women's and children's labor in the traditional setting may explain to a significant extent community differences in desired family size. The town community exhibits both the smallest family-size ideal and the lowest demand for children's or women's labor for the household economy, with the fishing village at the other end of the spectrum. In fact, the range of differences in desired family size among the villages is

greater than that among age or major socioeconomic groups, suggesting the importance of community or ecological factors in attitudes toward family building.

The Work Cycle

In the traditional economic sector, labor intensity, the work cycle, and the division of labor generally depend upon the types and sizes of subsistence economies. In the farming villages mentioned above, intensive labor input is needed from May to July and in September and October, while the period from November through February is a slack season. In the fishing village, labor input (particularly of women) is intense in May and June in connection with upland farming, and during the winter months from November to February because of off-shore sea-plant cultivation (or sea farming). The latter is most labor-intensive, and in this season all available hands except the very young and the very old are put to work from early in the morning until late at night. Similar, though slightly less, labor intensity is observed in farming during the busy seasons. On the other hand, no such distinctive work cycle is apparent in the town community.

The research reveals that the work cycle accounts for the seasonality of births and marriages, and points to problems in the family planning delivery system in the survey communities. Chun's analysis (1977b) shows that there are marked monthly differences in the frequency of births in the farming and fishing villages, and that these patterns coincide with the work cycle (that is, pregnancy takes place most frequently in the slack season, while the rate falls abruptly during the work season).[5] For example, the frequency of pregnancies peaks in September and October in the fishing village, and in December and January in the farming community. Similar, but more pronounced, patterns of seasonal variation are observed for marriages. According to 1974 KNFS data, about 57 percent of marriages for women aged 20-49 who grew up in rural areas are reported to have occurred during the three months from November to January; marriages during the four months from June through September account for only 5.7 percent. The corresponding figures for women who had grown up in the city are 39 percent and 14 percent, respectively.

These patterns have significant implications for family planning field services. Adequate delivery of these services is extremely difficult during the busy season. Field workers, who rotate regularly through each village, often cannot see any eligible women when they visit during the day because these women do not return home until late at night. Since the busy season extends to about six months a year, the rural work cycle should not be overlooked when family planning strategies are formulated.

Other Ecological Factors

Han and others include geographical location, housing, and the perception of community health conditions among the major ecological factors. The research found that, although the national family planning program was implemented all over the country, accessibility still constitutes a main factor in the availability of family planning services and information. For example, it was reported that field workers visited the fishing village only once a year even though they were supposed to inspect each village at least once a month. Furthermore, because of a lack of convenient transportation, compounded by geographical location, the villagers rarely visited any family planning clinic in the nearby town. A similar problem, though much less acute, was found in the mountainous village. Although a lack of contact with family planning workers was also prevalent in the town community, women there could readily obtain information and services through numerous drug stores and clinics. Accessibility was also found to be closely related to the community's general reaction to certain types of family planning methods, including sterilization: suspicion of a method was greater when accessibility was limited.

Housing conditions were identified as one of the key factors explaining the relatively low level of fertility in the town community. In that area, about one third of the total households live in rented rooms, and the number of children has many immediate implications for everyday living: it is difficult for a large family to rent a room, and couples with many children are usually under psychological stress because they are afraid their children will disturb the landlord. This is more or less a common feature of life for the urban lower class; it is manifested in slightly higher fertility than that of the

urban middle and upper classes, but much lower fertility than that of rural villager. Whereas concern about children's education is a major force limiting family size among the middle class, housing-related problems appear to exert a major pressure for low fertility among the urban lower class.

According to the anthropological type of study discussed above, individuals' perceptions of health and mortality conditions seem to mirror more the community or collective experience than their own personal history. For instance, the lower- and middle-class town community members generally have very similar perceptions of surrounding health and mortality conditions. Perceptions of the lower-class town residents are also far brighter than those of the farming villagers, who are economically better off. Undoubtedly, these perceptions are one of the important determinants of desired family size, and thus are related to motivation to regulate family size, not only in the survey communities but also in Korea as a whole.

Ecological Versus Sociocultural Factors

As discussed below in Chapter 5, various aspects of the Korean family system are closely associated with individual reproductive behavior, but the direction of these impacts is neither unidimensional nor unilinear. In the traditional family system, two mutually exclusive forces co-exist, one supporting high and the other low fertility. However, the significance of each force is not constant, but dependent upon the particular social milieu. A similar argument can be made about traditional cultural factors, though most of these are embedded in the family system. According to the findings of Han and others, observed differentials in both actual fertility and desired family size among the four communities are not substantially explained by sociocultural factors such as traditionalism, familism, and community solidarity. The ecological factors can have important implications for the community's fertility level, actual or desired. For example, the level of fertility in a community is influenced by whether the community is urban or rural and by the degree to which it is oriented toward industry, farming, or fishing. At the same time, within each community setting, sociocultural factors have behavioral implications at the individual or couple level.

Apart from the anthropological type of community study done by Han and others, most community-level analyses of fertility-related behavior have failed, as mentioned earlier, to produce any distinctive fertility differences by ecological or cultural factors. However, the persistent marked fertility differences between urban and rural areas and between large and small cities provide other indirect evidence of the importance of community and ecological factors. Confining analysis to agricultural communities, as is the case with most community-level studies done so far in Korea, seems very unlikely to lead to an accurate assessment of the ecological factors influencing fertility, since rural Korean farming villages display considerable homogeneity in their ecological and environmental characteristics, when contrasted with cities, fishing villages, mining communities, or farming villages undergoing rapid transition due to geographic proximity to expanding cities with industrial orientations. (Part of the lack of finding distinctive fertility differences by ecological or cultural factors in Korean studies, may be due to the choice of communities with little ecological distinctiveness.)

NOTES

1 Migrants moving from one rural area to another (rural-rural migrants) have fewer children than rural residents in general in all age groups, and migrants to Seoul from other cities have fewer children than residents of Seoul. Rural migrants to Seoul have even fewer children than Seoul residents below age 30, but not at older ages (Ro and Ahn, 1977).

2 The lack of a substantial effect of the community level variables in this study may be partly due to the limitations of the sampling design. The 53 villages included in the study are geographically adjacent to one another and are all in the same valley. Different results may have been obtained with a more dispersed and less well-integrated sample of villages.

3 Parts of the discussion below are extracted from Han and Kwon (1981); others are derived from the original, unpublished data source, if not stated otherwise.

4 Women's participation in rice farming has increased rapidly in the 1970s, due mainly to a severe shortage of male labor resulting from heavy rural-to-urban migration among the young.

5 Reliable reporting of the date of birth and the month of marriage according to the lunar calendar can easily be secured in Korea.

CHAPTER 4

MARRIAGE, THE FAMILY, AND FERTILITY

Demographic change in Korea cannot be fully understood unless it is placed in the context of marital institutions and the family system. The present chapter first examines the fertility implications of changing patterns of marital structure in Korea. The discussion then proceeds to the social norms regulating Korean marital behavior, and finally to the process of family building and organization.

PROPORTIONS CURRENTLY MARRIED

Marriage influences the reproductive behavior of individuals and determines a society's fertility level in many ways. It determines what proportion of women ultimately engage in reproduction, when reproduction starts, and how long on average a woman is exposed to childbearing. Universality of marriage, age at marriage, widowhood, divorce practices, and remarriage patterns are the major direct determinants of the marital structure of a society; however, all of these converge into the proportion of currently married individuals.

The proportion of currently married women is significant in understanding the level and structure of fertility in Korea since most births occur within wedlock. In traditional Korea, illegitimate children[1] were rare due to the custom of extremely early marriage and social approval of concubinage (D.-H. Kim, 1980:607-608). In addition, profound social and legal sanctions are known to have been exercised against illegitimate children. Recently, fertility surveys have documented an increasing proportion of premarital pregnancies, but most of these were reported as ending in live births within marriage.

According to S.B. Lee et al. (1978a), premarital pregnancy accounted for 26 percent of the total first pregnancies for 1974-76, while the premarital birth rate among first births was 6.2 percent; the corresponding figures for 1960-61 are 10.1 percent and 2.1 percent, respectively. If the premarital birth rate is calculated as a proportion of total births, it drops to about 2 percent during the years 1974-76. It should be noted that these rates do not account for births to unwed mothers, though this number is thought to be negligible. One more important observation is that the date of marriage reported in the survey frequently disagrees with the actual time at which the couple entered into a stable union: sometimes the wedding ceremony is performed after the marital union has begun. It has also been widely observed recently in Korea that many premarital pregnancies take place after the engagement. In other cases, marriage is forced because of premarital pregnancy to secure the legitimacy of the birth; if this is not successful, an abortion tends to result. Based on these observations, it may be concluded that illegitimate or premarital births are of very limited demographic significance, and that even in contemporary Korea, marriage primarily conditions reproductive patterns and behavior.

Table 15 shows that the proportion of currently married women of reproductive age has declined substantially since 1960. As would be expected, the changing pattern differs greatly according to age: the proportion decreased in the age groups below 30 and increased at ages 30 and above. The proportional decrease at younger ages is mostly explained by the rising age at marriage, and the increase at older ages by the decreasing risk of mortality. Given the relatively high marital fertility in the younger age groups and the rapidly declining marital fertility in older groups due mainly to wider use of effective fertility control methods, this changing proportion of currently married women has far greater meaning for community fertility levels at younger ages than at later ages.

NUPTIALITY AND FERTILITY[2]

As discussed in Chapter 2, a sharp downturn in fertility levels took place in the early 1960s. From 1925 to 1960, there was little variation in the TFR except during World

TABLE 15 Marital Status Distribution of Women by Age Group, 1935-75: Korea

Age	1935	1955	1960	1966	1970	1975
Proportions Single						
15-19	37.4	85.2	92.8	96.1	97.1	97.4
20-24	3.2	20.8	33.6	51.6	57.2	62.5
25-29	0.4	3.0	2.9	7.7	9.7	11.8
30-34	0.2	0.7	0.4	1.0	1.4	2.1
35-39	0.1	0.3	0.2	0.3	0.7	0.7
40-44	0.1	0.3	0.1	0.1	0.2	0.3
45-49	0.1	0.2	0.1	0.1	0.1	0.2
15-49	8.1	23.2	25.7	29.3	31.5	36.0
Proportions Currently Married						
15-19	61.6	14.3	7.0	3.8	2.8	2.6
20-24	94.7	75.1	65.0	47.7	42.3	37.2
25-29	96.6	89.7	93.3	89.8	88.4	86.8
30-34	95.1	89.8	91.9	93.9	94.6	94.4
35-39	91.9	87.0	88.4	89.2	92.0	93.2
40-44	86.3	81.4	82.4	82.7	84.8	88.2
45-49	78.6	73.6	76.3	75.2	76.8	79.1
15-49	85.6	67.8	67.4	64.2	62.9	59.5
Proportions Currently Divorced						
15-19	0.7	0.3	0.1	0.0	0.0	0.0
20-24	1.0	2.1	0.8	0.4	0.3	0.1
25-29	0.8	2.5	1.6	1.3	1.1	0.7
30-34	0.7	2.2	1.7	1.6	1.6	1.4
35-39	0.6	1.8	1.4	1.6	1.8	1.5
40-44	0.6	1.6	1.1	1.2	1.7	1.4
45-49	0.6	1.4	0.8	0.8	1.2	1.1
15-49	0.7	1.6	1.0	0.9	1.0	0.7
Proportions Currently Widowed						
15-19	0.3	0.3	0.1	0.0	0.0	0.0
20-24	1.0	2.1	0.5	0.3	0.2	0.1
25-29	2.2	4.8	2.1	1.2	0.9	0.7
30-34	4.1	7.4	6.0	3.5	2.4	2.1
35-39	7.3	10.9	10.1	8.9	5.9	4.6
40-44	13.0	16.8	16.5	16.0	13.4	10.1
45-49	20.7	24.8	22.8	23.9	21.8	19.6
15-49	5.5	7.3	5.8	5.6	4.6	3.8

Note: Data for 1935 are for all Korea; data for subsequent years are for South Korea only.

Sources: Kwon (1977, Appendix Table C); Korean Institute for Family Planning (1978, Section F).

War II and the Korean War, when fertility was somewhat reduced. Since fertility is a function of both the proportion married and marital fertility, the following discussion examines the relationship between these two components of overall fertility during the last few decades.

Coale (1965) has developed three indices that succinctly express the relationship between overall fertility and its components: I_f, an index of overall fertility; I_g, an index of marital fertility; and I_m, an index of the proportion currently married. These indices are defined such that when the number of illegitimate births is negligible (as in Korea), $I_f = (I_m)(I_g)$. Each index is confined to the range from zero (no childbearing, or no one married) to one (maximal fertility rates, or all women aged 15-50 currently married).

Table 16 presents values of the three indices for various dates from 1925-75 and for the urban and rural populations. The absence of a large difference between overall fertility in 1930 and 1960 is the consequence of opposing trends in the proportion married among women of childbearing ages, on the one hand, and marital fertility, on the other: the proportion married (I_m) showed an uninterrupted decline after 1930; marital fertility (I_g) was substantially higher in 1960 than in 1930. The constant trend in overall fertility until 1960 was therefore the result of counterbalancing opposite trends in I_m and I_g.

The trends in overall fertility and its two constituent components are shown graphically in Figure 7. Table 16 and Figure 7 demonstrate that I_g increased by almost 25 percent from 1930 to 1960, but fell by 23 percent over the entire period from 1930 to 1975; I_m, on the other hand, fell by 33 percent during the same 45-year period. Therefore, the decrease in proportions married contributed substantially more to the decline in overall fertility than did the decrease in marital fertility. The decline in I_m from 1930 to 1975 accounts for 60 percent of the decline in I_f. After 1960, however, I_g fell by 39 percent and I_m by 16 percent; hence 74 percent of the decline in I_f is attributable to the decline in marital fertility.[3]

Both the proportion married and marital fertility were consistently lower in urban than in rural areas. The extent of the decline in I_m was about the same in both areas. Urban I_g increased slightly more from 1930 to

TABLE 16 Indices of Overall Fertilty (I_f), Marital Fertility (I_g), and Proportion Married (I_m), by Urban and Rural Area, 1925-75: Korea

	Total			Urban			Rural		
Year	I_m	I_f	I_g	I_m	I_f	I_g	I_m	I_f	I_g
1925[a]	.879	.488	.556	.789	.390	.496	.883	.501	.568
1930[a]	.893	.484	.538	.744	.387	.500	.900	.499	.554
1935[a]	.883	.488	.540	.754	.381	.505	.893	.506	.567
1940[a]	.856	.491	.544	--	--	--	--	--	--
1955[b]	.715	.427	.598	.650	.371	.571	.738	.448	.606
1960	.704	.472	.670	.626	.362	.578	.740	.521	.705
1966	.658	.369	.561	.576	.258	.448	.710	.440	.620
1970	.632	.339	.536	.576	.286	.496	.686	.390	.569
1975[c]	.594	.245	.412	.555	.215	.387	.645	.284	.440

[a]Figures for 1925-55 encompass all Korea; figures for subsequent years are for South Korea only. Trial calculations for that period show negligible differences in the indexes for the whole country and for the area currently within the Republic of Korea.

[b]Based on average number of births, 1954-56.

[c]Births for 1975 assume a correction factor for the population aged 0-1 in the 1975 census equal to the average correction factor for the 0-1 age group in the 1966 and 1970 censuses.

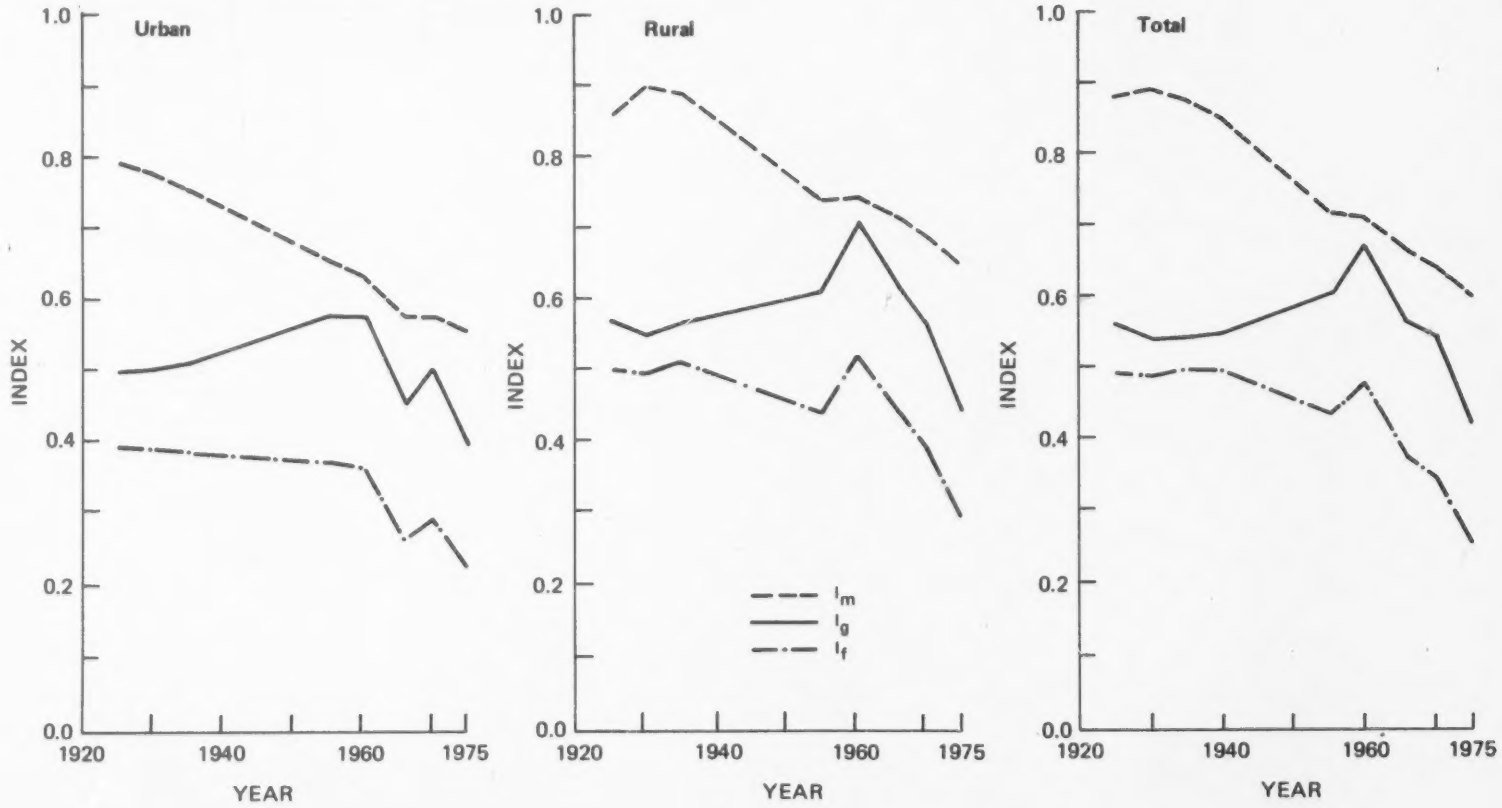
Source: Coale et al. (1979).

1955 than rural I_g, but between 1955 and 1960, urban I_g remained almost constant, while rural I_g increased by 16 percent. From 1960 to 1975, the proportionate decline in rural I_g was greater than that in urban I_g; that is, the fertility decline among the rural population was catching up with that among the urban population. The proportionate reductions in I_f, I_m, and I_g were greater for the total population than for either the rural or the urban population; this is partly due to heavy rural-urban migration in the 1960s and 1970s and resulting changes in the proportion of the population living in urban and rural areas.

PROPORTIONS DIVORCED AND WIDOWED

According to a series of censuses up to 1975, the proportion of currently divorced women in Korea has consistently been very low (less than 2 percent) and manifests no sign of significant change in any age group. However, this cannot be interpreted as indicating little recent change in divorce practices, since the proportion currently divorced is a combined effect of the

FIGURE 7 Indices of Overall Fertility (I_f), Marital Fertility (I_g), and Proportion Married (I_m), by Urban and Rural Area, 1925-75



proportion ever divorced and the rate of remarriage among the divorced.

In Korea, at least during the last two decades, the idea has prevailed that the number of divorces is increasing year by year. However, no supporting evidence is available. On the contrary, a resurvey of a middle-sized town discloses that the proportion of ever-divorced women among the ever married declined slightly during the period between 1965 and 1974: the proportion for ages 20-44 is reported as 3.1 percent in 1965 and 2.6 percent in 1974 (H.-Y. Lee, 1965:2-3; PDSC, 1975:1-2). Though not convincing, this suggests that the traditional stability of the Korean family still remains almost intact. However, it is interesting to note, as discussed later in this chapter, that the pattern of divorce has undergone a significant change since about 1960.

Little information is available for the nation as a whole on the timing and age pattern of marriage dissolution due to divorce. The 1974 KNFS is probably the only source of such data.[4] According to these data, the proportion of women who ended their first marriage by divorce is highest in the age group 40-44 (about 5 percent), and divorce occurs most frequently in a relatively early stage of reproduction, at an average age of 25-27 in the case of women (see Tables 17 and 18).

In contrast to divorce trends, both the proportion of widows and the probability of being widowed have been reduced greatly since 1955 in response to the rapidly declining risk of mortality regardless of age. As a result, the stability of marriage has strengthened substantially: the 1974 KNFS reveals that 95 percent of the ever-married women in the age group 30-34 are in their first marriage; the corresponding figure is 90 percent for the entire reproductive span, age 15-49, and about 80 percent for women age 40-44.

UNIVERSALITY OF MARRIAGE

As noted earlier, in traditional Korea, every man or woman was supposed to marry and set up a family. This universality of marriage was supported by the early age at marriage, and by the practice of completely arranged marriage; the strongest support, however, came from social custom and the family norm. Both legally and conventionally, there was a marked discrimination between

TABLE 17 Proportions of Ever-Married Women by Status of First Marriage, 1974: Republic of Korea

Age	Total	Continuing	Dissolved by		
			Divorce	Widowhood	Separation
15-19	100.0	100.0	0.0	0.0	0.0
20-24	100.0	99.1	0.5	0.2	0.2
25-29	100.0	98.1	0.9	0.5	0.5
30-34	100.0	94.7	3.0	1.7	0.6
35-39	100.0	89.5	4.3	5.5	0.7
40-44	100.0	80.7	5.0	13.5	0.8
45-49	100.0	70.5	4.9	22.2	2.4
15-49	100.0	89.7	3.1	6.4	0.8

Source: 1974 KNFS data tape.

married and single persons: the status of "adult" was often assigned to married persons only, regardless of their age; the style of hair was different according to marital status; in ordinary conversation, "elderly single men" were subject to severe ridicule; single girls beyond marriageable age were frequently treated as "helpless"; and the status of women was only determined by and within marriage (H.-Y. Lee, 1978:758-759). Such constraints, though weakened, still persist. Even today, permanent celibacy is rarely considered acceptable for ordinary people; single persons past marriageable age are derided by family members, friends, and colleagues.

The marital composition derived from a series of censuses reflects the intensity of this pressure to marry. In 1935, the proportion of single women was reported as 0.1 percent at ages 35-39. It has increased only slightly since then, reaching 0.2 percent at ages 45-49 in 1975 (see Table 15). The proportion of single (never married) women is expected to increase somewhat even in late reproductive ages in the years ahead because of a marriage squeeze resulting from the Korean War during 1950-53;[5] however, the ideas behind the universal marriage system are very unlikely to attenuate. In addition to this social atmosphere, institutional supports for the unmarried are not likely to evolve in the near future, given the apparent direction of the newly emerging social welfare development policy. The government has consistently emphasized the role of family and community in helping the needy, including the

TABLE 18 Mean Age of Women at Dissolution of First Marriage by Reason, 1974: Republic of Korea

Age	Divorced	Widowed
15-19	--	--
20-24	--	--
25-29	25.3*	--
30-34	25.1	27.4*
35-39	26.7	30.2
40-44	25.4	31.1
45-49	26.9	32.7
15-49	26.0	32.5

--: Fewer than 10 cases.
*: Between 10 and 19 cases.

Source: Calculated from the 1974 KNFS data tape.

elderly, and government subsidies are directed mostly to the family rather than to individuals. Thus, marriage still provides lifetime security for Koreans, particularly for women whose opportunity for economic activity is greatly limited by social custom.

Also supporting the universality of marriage is the widespread concept of "adequate timing of marriage" (hon-ki), a social norm applied particularly to girls. Although this concept has changed considerably since the 1920s, it has consistently played an important role in regulating the marriage behavior of Koreans. The range of ideal timing is narrowly defined, and is much narrower for girls than for boys. One begins to feel the pressure for marriage upon reaching this ideal age, although this pressure may have eased slightly during recent years as a result of the continuous postponement of the age at marriage.

TIMING OF MARRIAGE

Even though the traditional universal marriage system persists, the timing of marriage has changed substantially in Korea since the mid-1920s. According to a census estimate, the singulate mean age at first marriage was 21.1 for men and 16.6 for women in 1925, as is seen from Table 19. It rose to 27.4 and 23.7 for men and women respectively in 1975. The postponement of marriage has been an ongoing process during the last half century.

The prevalence of early marriage in traditional Korea is well documented. According to Kyung-kug tae-jun, a fifteenth-century Korean law book, the lower limit of the age at marriage was set at 15 for men and 14 for women; in exceptional cases, marriage could be allowed at age 12. The limit was raised to 20 for men and 16 for women in 1895. Interestingly enough, both laws state explicitly that the prevailing early marriage is a bad custom, and numerous historical documents condemn the early marriage custom as frequently impairing the health of the couple (D.-H. Kim, 1980:446-447; K.-K. Lee, 1977:229-231). In fertility terms, infecundity appears to have been caused often at early ages by early marriage, resulting in turn in a relatively low level of marital fertility in traditional Korea.

The initial rise in age at marriage in the mid-1920s coincided with the growing migration of Koreans to Japan and Manchuria, which was in turn a direct response to the rapidly deteriorating agricultural economy resulting from Japan's colonial policy of exploiting Korean agriculture to the maximum (Kwon, 1977:163-166). Single, male laborers were dominant in migration overseas during the colonial period (1910-45). The contribution of such a

TABLE 19 Singulate Mean Age at First Marriage by Sex, 1925-75: Korea

Sex	1925	1935	1940	1955	1960	1966	1970	1975
Male	21.1	21.4	21.8	24.7	25.4	26.6	27.2	27.4
Female	16.6	17.1	17.8	20.5	21.5	22.9	23.3	23.7

Notes: Calculation based on census data using Hajnal's method. Data for 1925-40 are for all Korea; data for subsequent years are for South Korea only.

Sources: Kwon et al. (1975); Lee and Han (1978).

population movement to marriage postponement for both men and women can easily be postulated.

The most drastic change in the timing of marriage is observed between 1940 and 1955, as is clear from Table 19. This period was marked by a large volume of migration in and out of Korea, and by social disturbance resulting from a series of political upheavals including World War II, the liberation of Korea from Japanese colonialism, the partitioning of Korea into two separate political entities, and the Korean War. These two factors, migration and social unrest, are regarded as largely responsible for the erosion in the custom of early marriage.

During the first decade of the post-liberation era, 1945-55, Korea experienced an unprecedentedly large influx of population into its territory. The number of persons who entered South Korea during 1945-49, consisting mostly of repatriates from overseas and refugees from North Korea, totaled 2.5 million, accounting for 69 percent of the total population growth during the period, or 12 percent of the total population at the 1949 census. During the Korean War years, 1950-53, about 650,000 North Koreans are estimated to have taken refuge in the South (Kwon, 1977). Most of the migrants at that time resettled where they did not have any solid base for living, largely in urban areas. Such circumstances would be incompatible with the practice of early marriage.

Traditional early marriage is only possible when a minimum amount of economic support from the family of orientation is secured. Otherwise marriage is likely to be postponed until the boy is old enough to participate fully in the labor force. During the late colonial years and the first decade of the post-liberation era, the economy deteriorated severely, and a majority of the population suffered from extreme poverty; in a word, economic conditions did not favor early marriage. Undoubtedly the sudden, unexpected start of the Korean War also caused a significant delay in marriage for persons of marriageable age at that time.

The rise in age at marriage has continued since the war, with the mean age at marriage reaching one of the world's highest levels in the 1970s. However, the pace of increase has slowed recently, and no further substantial postponement in the timing of marriage is expected. The most crucial determinants of change in age at marriage during the post-Korean War period are thought to be, as in the past, increasing economic constraints on

individuals, massive population movements from villages to cities, and the resultant rapid urbanization.

Rapid educational growth and expansion and compulsory military conscription of males for three years are also known to have played an important role in the postponement of marriage. Increased educational opportunities for females (Chang, 1980:88) have had both direct and indirect implications for age at marriage. In Korea, high school education usually ends at age 18 and college education at age 22. Marriage is rarely thought proper for students, even in college. As such, the growing proportion of women in higher education causes some postponement of marriage. Perhaps more important, however, is the indirect impact of education. As the proportion of women in tertiary education increased, marriage at a relatively late age became accepted as proper, and the ideal age at marriage moved up to 22 to 25, not only for college graduates, but for other women as well. High educational attainment is also observed to have motivated women to work for a few years before marriage.

The universal military conscription of men affects the age at marriage for both men and women because of the prevailing idea that the ideal age difference between husband and wife is three to five years. The census shows that the difference between men and women in singulate mean age at first marriage has been around four years since 1925. With the process of urbanization and modernization since the early 1960s, the patterns and conditions of mate selection have also undergone a change. Unlike in the past, a secure job or economic self-reliance has become the necessary condition for a man to get married in urban areas, and this is achieved in most cases some time after discharge from the military service.

Until recently, the movement of young, single individuals was the dominant pattern of rural-to-urban migration in Korea, and migration was heavy during the two decades 1960-80. Since migrants usually have problems adjusting to a new occupation, as well as to the urban environment and life style--though these are not as acute as in other countries (Green, 1977:268-300)--the massive migration since 1960 should have contributed greatly to the rising age at marriage for men and consequently for women.

The impact of age at marriage upon the level of fertility can be examined on two levels: the timing of marriage itself is the primary determinant of an individual's total reproductive period, and the change in age at

marriage may influence the general level of fecundity. In Korea, these two levels appear to have opposite fertility implications. The continuously rising age at marriage has contributed significantly to reducing the general fertility level by shortening the average reproductive span, as mentioned above. On the other hand, many studies have found that marital fertility in crucial reproductive ages increases with a rise in age at marriage. Based on the 1974 KNFS data, Moon (1980) observed that late marriage is associated with earlier births or shorter birth intervals in parities 1 to 3. Donaldson and Nichols's analysis (1978), based on a series of national fertility and family planning surveys of Korea, also shows that the tempo of family building has recently been much faster when the average age at marriage has been higher.

As noted above, historical documents suggest that traditional early marriage, frequently occurring at age 13 to 14, often meant that the bride was too young to be fecund. Therefore, the first child was not born for a few years in many cases. Evidently, the higher marital fertility of women in late marriage is also partly explained by the association between age at marriage and premarital pregnancy rates (S.B. Lee et al., 1978a). Even after allowing for such factors, the relationship between age at marriage and marital fertility is sustained to a significant degree. However, this impact on the level of births is felt far less than is the length of exposure to reproductive behavior (or marriage duration). In short, the postponement of marriage has persistently contributed to a net lowering of the societal fertility level. The 1974 KNFS shows a marked difference in the average number of children ever born between different marriage groups of the same birth cohort through all stages of reproduction. Also, multivariate analyses of fertility in Korea invariably disclose that age at marriage is a strong predictor of fertility (M.-I. Kim et al., 1974a; Shin et al., 1981). The explanatory power is greater at younger ages and largely vanishes in late reproductive ages (Kwon, 1982); this effect can be partly attributed to the faster tempo of family building among the later-married women, as discussed above.

Another important aspect of age at marriage, particularly in relation to fertility behavior, is its socioeconomic differentials. Late marriage is closely associated with high education, urban residence,

nonfarm/nonmanual occupations, and a modern value orientation (M.-I. Kim et al., 1974b; Y.-H. Lee, 1977). This pattern is almost identical to that of fertility, suggesting that the former is an important determinant of the latter, particularly in the earlier reproductive span, which is less affected by the deliberate attempt of individuals to control family size (M.-I. Kim, et al., 1974b; Shin et al., 1981).

DIVORCE NORMS AND PRACTICES

Traditional divorce norms manifest a marked distinction between men and women in Korea. Women were not allowed by law and social custom to divorce (or desert) their husbands. However, men could divorce their wives by law if one of the following seven prescribed conditions were met: showing a lack of filial piety to parents-in-law, failing to produce a son, being unfaithful, being jealous, having a bad disease, being talkative, or having a thieving habit. At the same time, Yi dynasty law postulated three exceptional conditions: a woman should not be divorced or deserted if she had completed two years of mourning for the parents-in-law, if she had married in poverty and achieved prosperity, or if she had no place to go.

However, it is generally known that conditions for divorce were associated with much stronger normative social sanctions than the conditions for not being divorced. In practice, women, especially if middle- and lower-class, could be deserted at any time if the husband or his parents felt it necessary. Nevertheless, divorce or desertion was strongly suppressed by familism, kinship, and community organizations. The major mechanisms for this were emphasis on family solidarity, concern with the "face" (or "dignity") of the family, and care for the children's future reputation, particularly in arranging their marriages. Consequently, despite frequent and sometimes very intense conflicts between a wife and her husband or between a wife and her mother-in-law, these were usually taken for granted and treated as within-family affairs, and the dissolution of marriage was therefore generally avoided. The acceptance of concubinage by society is also seen as an important institutional norm preventing marriage dissolution by divorce or desertion. It may be more proper to consider traditional Korean norms on desertion of the wife not as a force facili-

tating marital instability, but as a social mechanism for maintaining family peace. Numerous historical Yi dynasty documents confirm the conjecture that the practice of divorce was very restricted, and that the strong stability of the family was therefore sustained throughout the society (D.-H. Kim, 1980; K.-K. Lee, 1977).

Some conceptual clarification is needed for an analysis of divorce trends. In the Yi dynasty, the legal concept of divorce existed; however, legal divorce was very rare and practiced only in the upper yangban (ruling) class. Among commoners, divorce took the form of desertion, or forced ejection of a wife from the husband's residence. Unlike the vital registration system, censuses and surveys in Korea have collected information on this customary form of divorce. In other words, trends in legal divorce are revealed by vital registration, while those in customary divorce (though also including legal divorce) are revealed by the census and fertility surveys. Data from vital registration show a growing rate of legal divorce since 1960, though still a low level (Korea, NBOS, 1980a); on the other hand, various survey data reveal no increasing trend in customary divorce. This suggests that the custom of deserting a wife and social support for this custom have waned significantly with the process of modernization since 1960.

REMARRIAGE OF DIVORCED AND WIDOWED PERSONS

As is the case for divorce, the traditional norms on remarriage differed for men and women. The law, which incorporated the principles of neo-Confucianism, did not allow a woman to marry more than once in any circumstances, while divorced or widowed men were socially encouraged to remarry.

Though socially discouraged, remarriage of women was not uncommon in the past. It was often arranged even by the husband's family if a widow was very young and had no children at all. Various surveys around 1960 support this observation: a large majority of respondents (more than 90 percent) approved of the remarriage of women if there were no child, while the opposite was true if there were children (W.K. Koh et al., 1963:149-155; H.-J. Lee, 1959:59). Similar observations could be expected for more recent times. Concerning the prevalence of remarriage and its changing patterns over time, however, information is very limited. The 1974 KNFS, which may provide the

only useful information for the nation as a whole, shows the rate of remarriage for women aged 15-49 among women ever widowed or divorced to be 40 percent. However, as is seen from Table 20, the prevalence of remarriage differs greatly between women widowed and those divorced. The rate for the former is less than 30 percent, while the rate for the latter is nearly 75 percent in the entire reproductive age span. No equivalent national data on remarriage trends over time are available; however, two consecutive surveys in the same middle-sized town disclosed no increase in the rate of remarriage between 1965 and 1974 (H.-J. Lee, 1965; PDSC, 1975). The rate of remarriage for divorced women increases greatly with an increase in age, whereas for widowed women, there is a slightly declining tendency in the rate of remarriage at age 35 and above. This pattern simply reflects traditional remarriage norms. The customary law in traditional Korea prescribes that if a woman leaves the husband's family either for divorce or for remarriage, she has to give up every right in the family, including the claim for children. Accordingly, when a woman divorces or remarries, all ties, formal or informal, between the mother and children in the previous marriage are ordinarily severed. If there is no one in the family of the previous husband to take care of the children,

TABLE 20 Rate of Remarriage (in percent) by Reason, for Women Whose First Marriage was Dissolved, 1974: Republic of Korea

Age	Divorced	Widowed	Separated	Total
15-19	--	--	--	--
20-24	--	--	--	--
25-29	36.4*	--	--	21.7
30-34	68.8	27.8*	--	50.0
35-39	70.5	30.4	--	41.9
40-44	79.1	28.2	--	40.7
45-49	87.9	27.5	18.8*	36.9
15-49	73.5	27.7	16.3	40.5

--: Fewer than 10 cases in the denominator.
*: Between 10 and 19 cases in the denominator.

Source: 1974 KNFS data tape.

they are often adopted by the stepfather if the mother remarries; however, it is considered disgraceful for a child to change the surname due to remarriage of the mother.

Thus, divorce is discouraged when the couple has children, and is frequently related to having no offspring. Also, because divorce for women means a change of residence and the severing of ties with her children, remarriage is the only practical way to obtain social security for most divorced women. In contrast, a widowed woman is supposed to live with the previous husband's family, and if there are children, she is obliged to raise them. This fact partly explains why the rate of remarriage among widowed women drops in the later reproductive ages. In short, the existence of children has been the major consideration in the remarriage of women in Korea.

There is extensive social discrimination against remarried women in the Korean culture. As a result, remarriage generally results in a lowering of social status for women. Second husbands are almost invariably of a much lower social status and usually much older than first husbands. There is also discrimination against offspring from second or third marriages. For men, no change in social status results from remarriage. Even young single women are often willing to marry divorced men. If there are children, particularly sons, from a man's previous marriage, no children or very few are preferred in the second marriage.

It might be expected that these traditional remarriage norms, which still prevail widely, would have a fertility-lowering effect at the societal level. This effect could be assumed furthermore to have increased with the growing availability of fertility regulation since the early 1960s. However, the detailed implications of these norms for fertility are not simple to determine. The following is a list of coarsely postulated relationships between traditional remarriage patterns and fertility:

> Norms have discouraged the remarriage of divorcees and widows, and thus contributed to some reduction in the cohort of women exposed to reproduction.
>
> Social discrimination toward remarried women and their children constitutes a force motivating family-size limitation in subsequent marriages.

The strong discouragement of remarriage for women with children curtails reproductive behavior among women with high fertility for some time after the first marriage is dissolved.

THE FAMILY AND FERTILITY

In Korea, human reproduction can only be properly understood in the context of family building. Accordingly, studies of fertility have rarely failed to mention the importance of the family in accounting for the fertility behavior of Koreans. However, little research has been carried out primarily from such a perspective. Although some studies examine the impact upon fertility levels of a few selected family-structure variables, these are so crudely organized, or so fragmentary, that no general conclusions can be drawn. Furthermore, no single ad hoc effort has been made in Korea to identify the linkage between the family and fertility.

Most of these analyses are confined to the relationship between cumulative fertility and the current family composition of individual women, fertility differences according to the order of a husband among his brothers, and the association between the actual family size of the couple's parents and the couple's own family size (e.g., Chung et al., 1972; H.-Y. Lee, 1971; Kwon, 1982). The underlying hypotheses are self-evident: (a) the ideal of a nuclear family promotes low fertility attitudes; (b) because of pressure from relatives to continue the family line, the only son and the first son would tend to have higher fertility; and (c) the fertility behavior of individuals is socialized in the family of orientation. It is immediately apparent that the testing of these hypotheses requires very refined and sophisticated analyses, and that fertility differentials by the couple's family background would have only marginal significance for the overall relationship between fertility and the family. Most studies have revealed little association between the family background of individuals and the level of fertility. This may be interpreted as indicating that the family has little to do with the fertility behavior of Koreans; alternatively, it might be regarded as pointing to the inadequacy of the research methods and assumptions. To understand the relationship between fertility and the family, a holistic approach seems to be essential. The overall family-

building process, rather than cumulative fertility at a certain point in time, must become the focal point of attention. Moreover, instead of treating family-related factors as independent of fertility behavior, the two should be viewed as interconnected.

Bearing this in mind, the discussion below will try to hypothesize how Korean family structure was associated with fertility behavior in the past, and how this association has changed during the demographic transition and modernization. Because of the extreme paucity of empirical studies from such a perspective, this discussion will rely largely on speculation and will therefore often be hypothetical.

THE FAMILY SYSTEM

The family constitutes the most basic structure within Korean society. In traditional settings, the family was one of the major determinants of the social status of individuals, governed human interactions and relationships, provided a rationale for individual behavior, and thus shaped the basic value orientation of Koreans, which is termed "familism."

During the later half of the Yi dynasty, or the eighteenth through nineteenth centuries, the structure and ideals of the Korean family were organized strictly on the basis of male dominance; in short, the traditional Korean family was patriarchal, patrilineal, and patrilocal. This system naturally gave rise to male supremacy, not only in family life, but also in every aspect of social life, as well as to a preference for sons over daughters. Sex discrimination was so strong and pervasive that women were not allowed to mix with men on any occasion, private or public, and a wife was obliged to obey only the husband without any argument. All family property belonged absolutely to men. As noted above, divorce and remarriage norms were completely different for men and women. The family had a hierarchical rather than egalitarian structure: conjugal ties were neglected, and parent-child relationships occupied the pivotal position in the family and kinship network (J.-S. Choi, 1966:364-419); even among sons, there was discrimination according to birth order, as discussed below.

The ideal traditional Korean family was large and multi-generational in composition. However, such an extended family rarely dominated actual family life,

mostly because of poor economic conditions and high mortality (Lee and Kwon, 1968). Moreover, the principles of family building in traditional Korea did not strongly encourage the formation of, and living in, extended families. The extended family in Korea was organized as a "stem family", which was composed of parents and one of the sons' families of procreation, usually the first son's. Other sons were supposed to live with their parents for a couple of years after marriage, and then leave to build a separate household; if a son other than the first married after the death of the parents, particularly the father, he was compelled by custom to start a separate family from the beginning. In other words, the idea of a fraternal joint family was alien to Korean society. As a result, the dominant type of family actually implemented in traditional Korea was the nuclear family (Lee and Kwon, 1968).

One interesting question is whether the large family ideal is an inherent and indispensable component of the Korean family system. It is often argued that son preference, which constitutes the crucial part of the system, is responsible for the traditionally large family ideal, thus suggesting an essential connection between the family system and family-size values. However, various surveys on fertility and family planning in Korea disclose no congruence between shifts in son preference and desired family size. During the last two decades, a continuous rapid decline in desired family size has taken place, while son preference has waned little (Kwon and Lee, 1976; Kwon, 1976). This observation can be partly interpreted as indicating that the large family ideal is not primarily an outcome of the traditional family system; rather, that ideal seems to have been formed as a response to conditions of high mortality at the time, a necessity for the survival of both the family lineage and the society itself. If so, a greatly reduced mortality risk would result in a change in family size values without much normative constraint.

On the other hand, by examining the functions of children in the family, particularly those of sons, it may be seen that a large family is not a necessity, even in the traditional setting. The major obligations of children in the Korean family are the succession of the family name, ancestor worship, support of parents in old age, and the provision of labor. Among these, the first three are regarded as the responsibility of the first son. In short, one son is enough to fulfill most of the

functions of sons, and many are not required. In fact, mainly because of extremely poor economic conditions, many children were often thought to be a source of trouble, not pleasure. Again, compensating for such obligations, the eldest son was endowed with most of the family rights: he became head of the family in the father's absence and inherited the largest share of the family property, including residential quarters. In view of such meanings of children in the family, the traditional Korean family system cannot necessarily be thought to support a large family ideal and thus high fertility.

In traditional Korea, the meaning of the first son was almost absolute, and his status in the family was not comparable with that of any of his brothers and sisters. Accordingly, a preference scale among children can be hypothesized: the first son, other sons, and daughters. Most studies on gender preference and its implications for fertility in Korea have been based on the assumption that son preference would lead to higher fertility than is desired by the average family. However, as mentioned above, since strong son preference has persisted, despite the rapid tempo of fertility decline and the drastic decline in desired family size, this assumption is not supported. Kwon's research (1976) also demonstrates that son preference may not be a barrier to the decline of desired family size and thus to the reduction of actual fertility, and may well be compatible with a low-fertility ideal. Son preference undoubtedly influences the fertility behavior of individuals, but the direction of that influence is not unitary: for women who reach their desired family size without a son, it has a high-fertility implication; those who have enough sons but have not arrived at their desired family size may stop bearing children before reaching that desired number, so that son preference may have a low-fertility implication because of the relative unimportance of daughters. On an aggregate level, the counter forces may partially balance off. Consequently, there may be little impact of son preference on the level of fertility while the TFR is above a level of about three children; however, below this level it is likely that son preference will exert some influence, in part because the proportion of "no-son" outcomes increases as the average number of live births decreases, e.g., among couples with two live births, about one fourth will have two daughters. (For a fuller discussion of gender preference, see Chapter 5.)

Thus, the rapid decline in desired family size in the face of only a slight attenuation of son preference may well be explained by the strong first-son preference mentioned above.[6] This preference may be interpreted as indicating the limit of the decline in desired family size, that is, "at least one son." Because of the diminished importance of the second or third son, the diffusion of the one-or-two son ideal has encountered little resistance; in turn, given the preference of sons to daughters, there has apparently been a concomitant reduction in the desired number of daughters. Thus the drastic decline in family-size values in Korea during the last two decades (from 5 to 2.5 children on average) may be related, to a considerable extent, to the preference for first sons, as well as son preference in general. If this argument is accepted, it cannot be assumed that the traditional family system in Korea supports high fertility in all circumstances. Rather, that system can be postulated more properly as one factor--perhaps an important one--fostering a low-fertility attitude under conditions of low mortality, and inducing rapid fertility reductions when mortality declines. (These hypotheses about suggested fertility-trend relationships involving the strength and level of son preference deserve more research attention.)

FAMILISM

One of the most distinctive Korean value orientations having profound implications for fertility is so-called "familism," often used in contrast to the "individualism" prevailing in the Western world (H.-Y. Lee, 1978: 778-779).[7] Familism in traditional Korea defines the meaning of individual behavior primarily within the broad context of the family.[8] For example, one's success in the world gives one's family and relatives pride and, in a sense, social respect. Accordingly, the entire family not infrequently sacrifices itself to promote the success or education of a son. In return, he incurs substantial obligations not only to his immediate family members but to his relatives, at least emotionally. Therefore, family involvement in important events in the life course such as marriage, childbearing, and family formation becomes inevitable.

During the last few decades, particularly since the early 1960s, profound changes have taken place in every

part of Korean society; these are often characterized as "modernization" or "Westernization." Mounting concern has been expressed over the apparent rise of individualism in connection with Westernization. More recently, an attempt to vitalize some important components of traditional familism was launched with strong support from the government. It is questionable, however, to what extent individualism has penetrated into Korean society. Various social surveys have indicated that familism is still cherished by most Koreans, even in urban areas and regardless of age (Oh and Lee, 1980).

There have been some arguments that individualism, together with conjugal family ideals, is favorable to (very) low fertility in a society (Goode, 1963; Davis, 1957). It has also been observed in Korea that an individualistic value orientation is stronger among those with more modern, or less traditional, attitudes, and that modern ideals are associated with lower fertility (e.g., Chung et al., 1972:141-164). The inference is that individualism should lead to low fertility, even in Korea. The connection between the two is generally explained by the differing values attached to children, and by different value orientations in regard to individual happiness. It is nevertheless doubtful that familism, or collectivism in a sense, always supports high fertility. In fact, in Korea, familism has been found to be the major force in reducing fertility in recent times. The main rationale for fertility control lies not in increasing career or self-realization opportunities for women, but in providing children with better care or education; this strong concern about the future of children is regarded as a characteristic feature of traditional familism in Korea.

Another important aspect of familism as a factor in the societal level of fertility is its strong emphasis upon blood ties among family members. Unlike other societies, such as Japan, with similar family systems, Korea has very little adoption; adoption only takes place, according to traditional norms, when there is no (legitimate[9]) son in the family of the eldest son, which bears all the prescribed responsibilities for the ancestors. In such a case, the eldest boy from one of his brothers' families that has two or more (legitimate) boys is usually chosen. Frequently, the question of adoption is raised after the death of the first son in the main family[10] who has married but produced no son. The necessity of having a legitimate son was a severe

constraint mostly in the upper, or yangban, class (D.-H. Kim, 1980:228-291). For the majority of the population, however, illegitimate sons could inherit the family lineage if there were no legitimate son. As a result, concubinage was widely recognized as a way to secure at least one son in traditional Korea. In the traditional setting, the strong emphasis upon blood tie (or purity of blood) was a major mechanism for ensuring family stability even after the dissolution of marriage due to the death of the husband. Since concubines had, on the average, a smaller number of children than married women, this mechanism is thought to have significantly reduced the overall fertility level.

HUSBAND-WIFE RELATIONS

In the traditional Korean family, the suppression and regulation of sex were regarded as virtuous conduct for women, and frequent union of a couple was often considered obscene. As a regulation mechanism, strict segregation between men and women was imposed. For example, husbands and wives were not to face each other in private or in public, except in bed. Unfaithfulness of a wife to her husband was very severely punished. On the other hand, men's sexual impulses were channeled: their extramarital affairs with "women in the bar" (a kind of prostitute) were often encouraged as being "manly." Segregation between husbands and wives was so extensive that their spheres of interest were completely separate; the external world belonged to the husband and the "kitchen" to the wife, and each was supposed to be disinterested in the other's world. Though it was not expected that such norms would be observed strictly, they must have governed every aspect of Korean social life. If a woman lived in an extended family, her behavior was usually continuously surveyed by other members of the family, particularly the mother-in-law, who sometimes even regulated the couple's frequency of union. According to in-depth interviews on fertility behavior conducted in a middle-sized town,[11] many women could not feel love or affection for their husband until their mother-in-law died because of such intensive interference. These traditional marriage and family norms remain largely intact and are still taken for granted by most Korean families.

KINSHIP

In Yi dynasty Korea, kinship was organized by hierarchical principles and had the function of conferring social status on its members (M.-G. Lee, 1973:4-5). Thus, kinship background was sometimes a crucial determinant in the arrangement of marriage. The importance of kinship in traditional Korea can easily be demonstrated by the fact that most farming villages were, and are still, dominated by one or two kin groups bearing the same family name (M.-G. Lee, 1973). Strong emotional solidarity among kin members is noticed increasingly in rural areas (M.-G. Lee, 1973:345-350), reinforced by the extended family ideal discussed above. The major kinship obligations of individual members include observation of worship rituals for common ancestors, economic support to kin families in the case of such important family affairs as weddings and funerals, and aid to kin members in ordinary circumstances, as well as in emergencies. In other words, kinship ideology was the basis for social interaction and the major support for strong "familism" in traditional Korea, although, as noted above, familism is not necessarily related to large family-size desires, and thus probably did not significantly affect fertility levels even in the past.

Kinship ideals have become greatly attenuated in urban areas since the beginning of modernization and urbanization in the early 1960s; thus their influence on behavior generally, and on fertility levels in particular, is probably negligible. Even in rural Korea, kinship has been found to explain few of the community differences in fertility. For instance, two rural villages having similar socioeconomic characteristics except for their kinship systems (differing in the degree of kinship dominance, the closeness of the kinship network, and the degree of kinship involvement in everyday village life) show no meaningful differences in their fertility patterns.[12] The same study reveals larger family-size desires in a fishing village having little kinship solidarity than in the two rural (farming) villages. Hong's analysis based on data from 53 villages yields the same results (S. Hong, 1976).

NOTES

1 In this chapter, the term "illegitimacy" is used to refer to births occurring outside marriage in the customary sense. Traditionally, the concept was applied in Korea to denote children born to concubines.

2 For a more detailed discussion of the relationship between nuptiality and fertility, see Coale et al. (1979).

3 This finding was corroborated in Chapter 2 using a different approach.

4 The marital status of ever-married women from the 1974 KNFS closely matches that reported in the 1975 census, indicating the high reliability of the KNFS data.

5 According to the prevailing ideal age difference between husband and wife in Korea (3 to 5 years), women in the postwar baby boom generation are matched with men born during the war years. The sex ratio for these groups is less than 80.

6 According to J.-S. Choi (1966:642-644), among three societies in Asia, China, Japan, and Korea, which share much of a common cultural heritage, Japan shows the strongest first-son preference and China the least in power relations and property distribution among brothers. However, the first son is most important in Korea in the succession of the family lineage.

7 Familism in Korea has features in common with familism in China, as outlined in Levy (1955).

8 The concept of family was shared by close relatives in traditional Korea. The Korean term "jib," which stands for family, represents such a concept (J.-S. Choi, 1966:631-638).

9 Following the usage in traditional Korea, legitimacy is used here to denote the status obtained through legal marriage. The principle of monogamy was applied to define the legitimate couple.

10 The main family, called "bon-ga" in Korean, refers to the family succeeded by the eldest son consecutively.

11 The record, unpublished, contains details of in-depth interviews of about 100 selected women, conducted as part of the 1965 Ichon survey on fertility and the family.

12 This survey, conducted by Han and others, was discussed in more detail in Chapter 3.

CHAPTER 5

THE DEMAND FOR CHILDREN

The motivation to control fertility in a society depends on both the demand for children and the supply of children. Over the last quarter of a century, Korea has experienced both a rapid decline in fertility and a substantial transformation in the demand for children. This chapter examines in detail the components of the demand for children in Korea and how changes in that demand have influenced the course of Korean fertility. The first section reviews changes in ideal family size over time and differentials in family-size norms among different groups. The second section explores the values and disvalues that parents attach to children and the extent to which these have changed with modernization. The final section focuses on the continuing strength of son preference as an integral part of the Korean culture; the historical background of this preference is outlined, a number of independent measures are used to examine its current levels, and the continuing debate about how it will inhibit further fertility declines is discussed.

FAMILY-SIZE DESIRES

Since the late 1950s, the number of children Korean couples consider ideal has changed considerably. Although there are questions about the quality of the available data and about the meaning of this concept generally, there are strong indications that the ideal family size in Korea has been cut almost in half over a period of slightly more than two decades. The evidence for this rapid decline is shown in Table 21. The pattern indicated is a slight decline in ideal family size prior to 1965, a possible brief plateau in the late 1960s, and

TABLE 21 Average Number of Children Considered Ideal: Republic of Korea

Year	Ideal Number of Children	Survey	Source
Before 1960	Approx. 5	Several early surveys	Kwon and Lee (1976)
1958	4.4	Urban survey	Chung et al. (1974)
1965	3.9	KAP Survey	Moon et al. (1973)
1966	4.3	Special Demographic Survey	Choe and Park (1969)
1967	3.9	KAP Survey	Moon et al. (1973)
1968	3.9	1968 Fertility Survey	Moon et al. (1973)
1971	3.7	1971 Fertility Survey	Moon et al. (1973)
1971	3.6	KIRBS Survey	Chung et al. (1972)
1973	3.1	1973 Survey	S. Hong (1978)
1974	3.2	Korean National Fertility Survey/ World Fertility Survey	Korea, NBOS and KIFP (1977)
1974	3.0	National Survey of Family Planning Information, Education and Communication	Cheong et al. (1979)
1976	2.8	National Fertility and Family Planning Evaluation Survey	Cheong et al. (1979)
1976	2.7	Survey of Economic Factors in Fertility	N. H. Cho et al. (1977)
1976	2.6	Value of Children Survey	Bulatao et al. (1978)
1978	2.7	Study of Family Planning Information, Education, and Communication	Cheong et al. (1979)

an accelerated decline during the 1970s. Although these temporal changes should be interpreted cautiously because of differences in survey coverage and question wording,[1] the trend is obvious. It is interesting to note that changes in family-size norms roughly parallel declines in actual fertility during this period. It is difficult to disentangle the direction of causality between these two measures; however, declines in ideal and actual fertility seem to have reinforced one another.

The overall averages in the ideal number of children mask some interesting differences in the distributions. Up through 1971, available data show that virtually nobody considered less than two children an ideal family. More recent surveys are consistent with this pattern, although a few percent of respondents in some studies consider one child ideal. The two-child family, which the family planning program would like to establish as the norm, was similarly unpopular through 1971, with only 4 to 6 percent of respondents expressing this as their ideal (Korean Institute for Family Planning, 1973).

However, since that time, the two-child family has rapidly become a more acceptable ideal: in recent surveys, between one third and one half of Koreans say that their ideal number of children is two (Moon et al., 1973; S. Hong, 1978; Bulatao et al., 1978). The three-child family has similarly gained in popularity, with corresponding losses in the acceptability of large families (five or more children).

This development of two to three children as the most desirable family size is confirmed by data on the proportion of women at various parities who do not want any more children (Table 22). With each successive survey, more and more women at each parity say they prefer not to have any more children. Although the proportion of first-parity women who are content to stop bearing children has increased sharply from 7 percent in 1967 to 26 percent in 1979, the vast majority of women would still not be satisfied with one child. However, the trend at the second parity has been more dramatic: in 1967, only 15 percent of women with two children wanted to stop childbearing; just twelve years later, more than three fourths professed to be satisfied with two children. Once the level of three children has been reached, only a small percentage of women (7 percent) say they wish to have one or more additional children.

On the other hand, women will not necessarily be able to attain their ideal family size. A few will be unable to have families as large as they would like, for example because of fecundity impairments. Many more will exceed their ideal family size or have already done so; in fact, in the World Fertility Survey, 34 percent of currently married women already had a larger family than they desired, and 37 percent said they did not want their last live birth.

In addition to the evidence that the ideal number of children is dropping, there are some indications of a corresponding decrease in the ideal spacing of children. The ideal first birth interval dropped by one sixth (from 21.1 months to 17.6 months) between 1976 and 1978. The ideal spacing for subsequent births declined from 3.6 years in 1974 to 3.4 years in 1976, and further to 3.2 years in 1978 (Cheong et al., 1979:82). Moreover, in all three years, ideal birth intervals drop steadily as one moves from rural areas to large cities (Cheong et al., 1979:82; B.T. Park et al., 1979:54; C.H. Choi et al., 1975:24). Thus, it appears that the ideal life cycle for most people in Korea now includes a fairly small number

TABLE 22 Proportion of Women Who Want No More Children: Republic of Korea

Number of Living Children	National Survey on Family Planning 1967	Korean Fertility and Family Planning Survey 1968	National Family Planning and Fertility Survey 1973	Korean National Fertility Survey 1974	National Fertility and Family Planning Evaluation Survey 1976	Korea Contra-ceptive Prevalence Survey 1979
1	7	8	11	13	19	26
2	15	24	46	66	69	78
3	55	54	73	86	88	93
4	74	73	85	92	93	97

Note: The characteristics of women included in the calculation of the above figures may differ from one survey to the next. For example, the Korean National Fertility Survey figures for 1974 are based on currently married fecund women, whereas other surveys may be based on all currently married women. Using a similar definition across all surveys would apparently further heighten the increase over time in the proportion who want no more children.

Sources: B.T. Park et al. (1979:98); Korea, NBOS and KIFP (1977); K.S. Koh et al. (1980b).

of children, born within a relatively short space of time, leaving women with a smaller proportion of their adult lives devoted to childbearing and childrearing. Although the shifts in ideal spacing parallel actual declines in birth intervals at the lower parities, it is once again difficult to tell whether these shifts are leading or following actual changes (Rindfuss et al., 1982).

The ideal age for a woman to complete childbearing remained constant at 31 years over the 1974-78 period (Cheong et al., 1979:82). KNFS data on the proportion of currently married fecund women who want no more children support this observation. At age 25-29, 46 percent of women say they want to have additional children; by age 30-34, this figure is only 16 percent (Korea, NBOS and KIFP, 1977). Even though most women in the younger cohorts want to have more children, their ideal family size is relatively low (about one child lower than for those at the end of their childbearing years). In fact, women age 15-24 have a slightly lower ideal number of children than those in the same age group in Japan (B.T. Park et al., 1979:91). However, there is no way to know whether this ideal number will increase as they pass through their childbearing years.

The Korean National Fertility Survey has also revealed that better education and urban residence (in addition to younger ages) are associated with smaller family-size norms (Korea, NBOS and KIFP, 1977). Family-size norms have consistently been 17-19 percent higher in rural than in urban areas in nearly every survey over the last 15 years. In the most recent nationwide survey (Cheong et al., 1979), ideal family size rose from 2.5 in Seoul, to 2.6 in other cities, to 2.8 in eups (townships), to 3.0 in myuns (rural administrative units). Even within Seoul, there is evidence of different family-size norms in different sections of the city. For example, in a 1971 survey, Chung et al. (1972) found that women in the central or "lighted" areas of Seoul had an ideal family size of 2.88 children, while those in the marginal or "blighted" areas thought 3.33 children ideal.

These differences in family-size norms by urban-rural residence, education, and age are undoubtedly related to the varying roles that children can be expected to play in the lives of people in different circumstances. The next section examines the values that Korean parents attach to children, and how these values change for parents at different stages of the life cycle and in different circumstances.

THE VALUE OF CHILDREN

Attitudes toward the values and disvalues of children appear to be one of the key factors determining family-size attitudes and fertility behavior in Korea. Some values are almost universally attached to children, others are salient to only certain groups, while others have essentially lost their importance or were never very prominent. As noted above, children are seen as performing different roles or functions for different people; moreover, attitudes toward children change throughout the life cycle of individuals and as modernization proceeds. The value of children changes from one parity to the next as parents add to their childbearing experience; it also depends, in large measure, on the sex of the child.[2]

Although very little was known about the value of children in Korea before the early 1970s, a considerable body of literature addressing this question has recently emerged. In 1957, Leibenstein developed a useful general framework that grouped the benefits of children into three broad categories: (a) their utility as productive agents, helping with the family farm or business, or earning family income; (b) their utility in providing security for parents in old age and in times of emergency; and (c) their psychic or "consumption" utility, i.e., the utility of children as a source of personal pleasure to the parents. The costs of children were divided into direct, out-of-pocket costs of raising children and opportunity costs. This framework is employed below to examine the values and disvalues of children in Korea.

The Productive Utility of Children

Although there is a good deal of evidence showing that children provide help in family enterprises, it is not at all clear that this productive utility is a strong motivation for having children. The Survey of Economic Factors in Fertility found that over 60 percent of married women expected help from their children on the family farm and about 20 percent in the family business.[3] However, in the same study, this benefit was almost never mentioned as the most important reason for having children. This pattern is even more evident in the case of practical help around the house: the Value of Children (VOC) study found that over 80 percent of parents expected both daughters and sons to help around the

house, yet only a handful of respondents spontaneously mentioned this type of help as an advantage of having children (Bulatao, 1979). Moreover, the productive utility of children normally declines with the relative importance of agriculture and the need for family workers. It may be noted that large-scale migration from rural to urban areas in Korea may be producing a somewhat different pattern: migration to the cities has caused considerable rural labor shortages that may temporarily increase the value of children's work, especially for poorer rural families. However, in the long run, the productive utility of children will inevitably decline.

The Security Utility of Children

Security has been cited as one of the most compelling factors in family-size decisions in countries in which social security programs are nonexistent, do not have widespread coverage, provide inadequate support, or are unreliable. In Korea, where there is no government old age security program, children are still viewed as an important source of old age support and a cushion in times of need. However, the security utility of children is declining substantially as family nucleation proceeds, as parents find they can rely more on their own income or savings, and as children are perceived as less willing to help their parents financially (Lee and Kim, 1979). Although children often figure prominently in plans for old age support, the degree of support may be relatively small. In the VOC study, over 80 percent of wives and husbands said they expected old age support from their sons and about 45 percent from their daughters. However, only about one respondent in five spontaneously mentioned help in old age as an advantage of having children (Bulatao, 1979); about the same proportion cited this as a very important reason for wanting another child (Lee and Kim, 1979). The commonly supplemental nature of children's security contributions is further seen in Table 23, which shows that a substantial proportion of women expect to be basically independent of their children after retirement. This emerging independence is further evident from data on household structure and living arrangements. For example, the Survey of Economic Factors in Fertility found that 48 percent of women in their childbearing years do not expect to live with their children at all, 22 percent expect to live with them for

TABLE 23 Expected Economic Support After Parents' Retirement: Republic of Korea

	Sons (percent)	Daughters (percent)
Total Support	39.3	1.0
Moderate Support	18.4	2.8
Little Support	25.6	22.5
No Support	16.7	73.7
Total	100.0	100.0

Source: N.H. Cho et al. (1977:76).

as long as possible, while 25 percent expect to live with them only when they are old.

Nevertheless, for substantial segments of Korean society, children are still seen as the primary source of security in old age. This is particularly true for older couples, those who live in rural areas, and individuals with low income and little education. The differentials by type of place of residence are quite striking. In the first phase of the VOC study, only 3 percent of urban, middle-class respondents rated help in old age as a very important reason for wanting another child, compared to 26 percent of urban, lower class respondents, and 43 percent of rural farmers (Lee and Kim, 1979). These differentials suggest that the security utility of children will continue to decline with increasing urbanization and development.

The security utility of children might also decrease if an old age security system were introduced. The Survey of Economic Factors in Fertility found that 68 percent of parents would stop at two children, even if they had no sons, if there were an old age security system in Korea. Although such hypothetical survey questions are always somewhat suspect, it is obvious that a large number of women do make the connection between old age security and family size in their minds.[4]

The Consumption Utility of Children

In addition to the economic factors considered above, parents may derive a wide range of social-psychological benefits from children. Some of those values mentioned prominently in Korea are happiness, love, companionship, the personal development of the parents, and a whole host of childrearing satisfactions (Lee and Kim, 1979). There is also some evidence that this "consumption" utility is greater among young, better-educated women in urban areas (N.H. Cho et al., 1977). As will be seen below, these benefits of children are particularly associated with the first child. This does not mean that rural, less-educated couples and high-parity women do not derive personal pleasure from their children; rather, it indicates that economic factors and other considerations may take precedence for those individuals.

Other Values of Children

The above categorization omits some additional values or considerations which relate more narrowly on the children themselves. Some of these are benefits that accrue to other children in the family rather than directly to the parents: children can provide companionship for each other, and older children can help their younger siblings with school expenses. The Survey of Economic Factors in Fertility reported that when asked about the disadvantages of a small family, 62 percent of women mentioned that the children may feel lonely, and this was by far the most common answer; companionship for children was found to be a particularly important value for couples with two to three children (Bulatao, 1979).

The number of siblings also has implications for the quality of children, their relationship to their parents, and even their personalities. Korean children from large families are seen as having an open and loving manner toward other people, being self-confident, and being popular with other children. Children from small families are thought to have high intellectual ability and a close relationship with their parents; they are also seen as being very happy, but rather spoiled (Lee and Kim, 1979:63). Although children from large and small families may not objectively possess these characteristics, the perception that they do may be a factor in fertility decision making.

Direct Costs of Children

The benefits of having children must be counter-balanced against the costs entailed in rearing them. In Korea, several studies have shown that parents are acutely aware of the high costs of children; the costs of raising children have consistently emerged as the most important perceived disadvantage of having children, of having a large family, and of having another child (Lee and Kim, 1979). Some would argue that survey respondents may simply mention costs as a convenient rationalization of what is in reality a very complex decision--not to have more children. This argument is partially supported by the results of hypothetical questions on what people would do if their income doubled. In one study, only 7 to 14 percent of respondents said they would have more children if their income doubled (Arnold et al., 1975:96). In the Survey of Economic Factors in Fertility, only 0.4 percent said they would use the extra money to have another child, while 43.6 percent would use it for the education of their other children. Thus, the money, if spent on children at all, would be used to increase the quality rather than the quantity of children. Lee and Kim (1979) found that 57 percent of men and women said the number of children they desired would be a heavy economic burden to them. Thus other factors must compel the majority of couples to have more children than they feel they can comfortably afford. Nevertheless, the prominence of cost considerations in every study to date cannot be ignored. Only a minority (about one in five) of Koreans feel that two children would be a heavy economic burden; this figure rises sharply to nearly two thirds for three children, and around 90 percent for four children (Lee and Kim, 1979). Since this is the range within which childbearing decisions will be most crucial over the next decade, perceptions of the costs of children should be carefully considered.

Measuring the actual costs of children, rather than perceptions of them, has proven a difficult task; thus there are virtually no reliable data to cite. A survey conducted late in 1972 (Lee and Kim, 1979:58) reported that urban middle-class couples estimated the average expenditure on their children during the previous 12 months at about $473 (or 21 percent of their total income). Urban lower-class couples figured they spent only about half that much ($243), but this level of expenditure ate up 29 percent of their total income.

Couples in the rural, agricultural sample estimated that they spent only 15 percent of their income ($133) on their children. This economic crunch seems to fall most heavily on lower-class couples in urban areas. This is in fact a common phenomenon resulting from a combination of the high cost of living in urban areas, low incomes, and relatively large numbers of children (Arnold et al., 1975).

A study by the Korean Educational Development Institute conducted somewhat later than the one just mentioned attempted to estimate the cost of rearing a child from birth to age 25 (Kim et al., 1976:65). The authors estimated the cost for a middle-class couple at about 15 million won (about U.S. $31,000) according to prices at the end of 1975. If these figures are even approximately correct, then costs must be a substantial factor in family-size decisions, at least for middle-class couples.

One of the principal components of the cost of children, and one of major concern, is the cost of education. Although the government covers most of these costs through junior high school, they can still be considerable for parents, who often pay for private schools, books, tuition, school clothes, and special lessons such as those in music or sports. One of the greatest expenses incurred in educating children has been that of private tutors. The government has recently made private tutoring illegal in an attempt to reduce this economic burden. However, while this law will undoubtedly make educational expenses easier to bear, it will by no means make children's education inexpensive. Educational aspirations in general are very high in Korea, and parents are willing to make considerable sacrifices to provide education for their children. Education is now compulsory through the sixth grade, and there are plans to extend compulsory education through junior high school soon; however, most parents want their children (or at least their sons) to finish college, while a large majority would like them to graduate from high school (Moon et al., 1973). The Survey of Economic Factors in Fertility found that education was the single most expensive aspect of raising children, followed by food and clothing. In the same study, three fourths of the parents interviewed said that the cost of educating their children would be a very heavy burden considering their income level and status. A substantial proportion of Korean couples state explicitly that the high cost of

education is a reason for not wanting another child (Lee and Kim, 1979), although the influence of this factor on actual childbearing decisions is still open to question.

The Opportunity Costs of Children

The indirect or opportunity costs of children encompass a variety of restrictions on parents' alternate activities, but among these, perhaps the most important is the restriction on one's job. These costs are thought to affect women more than men since women usually bear the brunt of childrearing responsibilities. However, opportunity costs are often thought to be minimal in less-developed countries (particularly in rural areas), where many jobs for women are compatible with child-rearing (or where job opportunities for women are limited) and where easy alternatives exist for child care through the extended family or friends. In Korea, opportunity costs are not highly salient, but neither are they negligible, and they are gaining in importance. Restrictions on alternative activities are felt most strongly in urban areas, particularly among more educated women (Arnold et al., 1975; Lee and Kim, 1979). Although women do manage to combine working and childbearing successfully, the Survey of Economic Factors in Fertility found that 40 percent of working women felt childrearing interfered greatly with their work, while 30 percent said it interfered somewhat. As educational opportunities for women continue to improve in Korea, opportunity costs will undoubtedly increase as they have in more developed countries.

Other Costs of Children

Other costs of children include both emotional and physical costs and costs to society. Two of the strongest reasons given for not wanting another child are emotional strain and potential problems between husbands and wives (Arnold et al., 1975). Although these emotional costs were not rated as highly as the financial costs, they were still quite important; the physical burden of caring for another child was among the least important reasons, except in rural areas. There was also a very strong concern that having another child would prevent the parents from giving sufficient attention to their other

children. It appears that these nonfinancial costs are not entirely anticipated prior to childbearing: R.-Y. Park (1980) found that the financial burden was of the greatest importance to couples before they had children, but the emotional and physical burdens were given most importance by couples who already had children.

As mentioned earlier, Korea has one of the highest population densities in the world, and Korean couples profess a good deal of concern about overpopulation. For example, in the VOC study, over 70 percent of wives and husbands said they felt that overpopulation was a reason for their having fewer children (Bulatao, 1979). Although these answers must be interpreted cautiously (particularly in light of the fact that answers about overpopulation rarely surface spontaneously), it is interesting to note that the figures for Korea were higher than those for any of the other countries included in the study. Korean couples seem to be acutely aware of crowded conditions and their attendant problems, particularly in the cities.

Parity-Specific Values

The above discussion of values and disvalues generally treats all children as equal. Yet children of different birth orders, different sexes, different ages, and so on, are perceived differently by parents. A recent article by Bulatao (1981) focuses on differences in the value of children in successive childbearing decisions both in Korea and elsewhere. The relevant data for Korea, reproduced in Table 24, show quite pronounced differences by birth order in both the values and disvalues. On the positive side, the first child provides a number of social-psychological benefits, many of which are derived from interaction with the child; it is seen as bringing the spouses closer together, although it can also interfere with the marital relationship by restricting the amount of time that spouses can spend together. The first child is unique in that only one of the five values mentioned (incentive in work) is prominent for any other child. The importance of providing companionship for other siblings emerges for the second and third child and then disappears. Considerations of gender preference come to the fore with the third and fourth child, but do not seem important for subsequent births. Finally, it is not until the fifth child and beyond that economic benefits become a prominent concern.

TABLE 24 Values Attached to the Next Child: Republic of Korea

	Values	Disvalues
1st Child	Love and care for Incentive in work Fun around house Bring spouse closer Pleasure to watch grow	Child's sickness We are too old Hard to discipline Less time with spouse
2nd Child	Companion for siblings Incentive in work	Harder to have job Less free
3rd Child	Wants a girl Companion for siblings Wants a boy Incentive in work	Less time with spouse Overpopulation
4th Child	Wants a girl	Financial burden
5th Child	Help around house Economic help	Financial burden
6th and Subsequent Children	Economic help Help in old age Help around house	Financial burden Child's sickness We are too old

Source: Bulatao (1981:12, 18).

On the cost side, the differences are also striking. Opportunity costs become important in the case of the second child, and then fade. Overpopulation is an important consideration for the third child, as might be expected in light of the family planning slogan "Stop at two without sex distinction." After the third child, financial costs are paramount at every level.[5] The particular values that are important for each child have important policy implications. For example, if one wanted to encourage couples to stop at two or three children, policies designed to increase sexual equality and decrease gender preference would seem appropriate, although, as the next section will demonstrate, the influence of gender preference on fertility in Korea is not as clearcut as many believe.

SON PREFERENCE

One of the most deeply ingrained values in Korea, both historically and at the present time, is a preference for male over female offspring; in fact, Korea exhibits one of the highest levels of son preference in the world, a topic that has received considerable attention in the literature (see, for example, Chung et al., 1974; Kwon and Lee, 1976; Kong and Cha, 1974). Although there are some signs that son preference is beginning to relinquish its strong hold in Korea, its continuing importance cannot be questioned. Korean society has indeed gone through a drastic transformation; however, satisfactory institutions have not yet emerged to take over the major functions of sons in the traditional Korean family (Kwon and Lee, 1976).

Historical Supports for Son Preference

Son preference has a long history in Korea, but "it was not until after the establishment of the Yi dynasty (near the end of the fourteenth century) when boy preference received institutional support in the form of Confucianism that it took on aspects of a culture" (Chung et al., 1974:77). Under the Confucian system of the traditional patriarchal family, a male child was seen as crucial for carrying on the family name, for the rituals of ancestor worship, and for inheritance purposes. Having as many sons as possible was regarded as one of the five blessings (obok). In the Yi dynasty, the right to preside over the rituals of family ancestor worship (chesa) would pass down to "the eldest son, other sons, sons of concubines of decent origin, and sons of concubines of lowly origin in that order" (Chung et al., 1974:56).

Inheritance laws have often favored sons, particularly the eldest; however, even when the law entitled all children regardless of sex to equal shares in the family property (as was the case during the Yi dynasty), in practice, inheritances almost always excluded women (Chung et al., 1974). Current Korean law states that women in a family <u>may</u> inherit on an equal footing with men (United Nations Fund for Population Activities, n.d.), and a law is being considered that would make this mandatory. However, until 1978, Korean law entitled unmarried daughters to receive only half as much inherited property as sons and married daughters to receive only one fourth as much

(Chung et al., 1974). The Survey of Economic Factors in Fertility found that 76 percent of Koreans expected to bequeath the family farm to their first son, 19 percent would share the land among their sons, and only 3 percent would share the land among both their daughters and their sons. In a rural area of Korea, Yoon (1974) reported that in practice, the first son receives all of the family's land and goods because of poverty and a lack of land to be divided.

The low status of Korean women also contributed to the strong desire for male offspring. During the Yi dynasty, all formal educational institutions were open only to men. Young girls were told that women who know letters are short-lived and short on fortune (Chung et al., 1974:62). Women were also taught the womanly virtue of the three obediences: a woman was expected to obey her father when she was young, her husband after marriage, and her sons (particularly the eldest) after she became widowed.

The traditional importance of sons in Korean society is demonstrated by the lengths to which people have gone in order to have a son. Chung et al. (1974) outline a whole range of common practices such as son praying (including rock worship and wood worship), geomancy (selecting auspicious grave sites), studying the physiognomy of son-bearing women, navel cautery, and name-giving practices. Although some of these customs are no longer widespread, others are still often practiced. Son preference has also been supported by a whole host of Korean folk sayings, some of which still enjoy considerable currency; the following are examples (Kong and Cha, 1974; Chung et al., 1974; N.H. Cho et al., 1977):

> "Children are valuable, but especially sons, regardless of the number."
> "A daughter lets you down twice: when she is born and when she gets married."
> "If a man should die sonless, no one would ever offer him even a bowl of water."
> "If you have to marry someone you dislike, give him many daughters."
> "A new-born son should be laid on a bed, clad in fine clothes, and given precious stones to play with, while a girl at birth should be left on the floor with only a diaper on and given only pieces of roof-tile to play with."

"Women not flogged for three days turn into foxes and climb mountains."

Although a number of current laws in Korea discriminate against women, much of the male bias that previously permeated Korean law has been eliminated (B.H. Park, 1973). These legal changes have been accompanied by increasing opportunities for women's economic and social participation and by changes in women's roles (H.-S. Park, 1979). Nevertheless, strong boy preference attitudes persist in Korea, as the next section will show.

Measures of Son Preference

The existence of a strong preference for sons in Korea is one of the best documented facts in Korean population studies; it is supported by every measure of son preference that has been used (including the ideal number of sons and daughters, parity progression ratios, reported sex ratios of children, the Coombs sex preference scale, and the ideal sex of next births). An overriding desire to have at least one son (and often at least two) is nearly universal.

The evidence on changes in the level of son preference over time must be carefully analyzed. Some studies show that there has been little if any change, while others indicate a gradual downward shift. A review of ten surveys between 1958 and 1978 conducted for the present study showed virtually no change over time in the proportions of boys and girls in the ideal family; in fact, the average proportion of sons in the ideal family was precisely the same in the earlier five studies as it was in the five most recent studies. All but one of the studies indicated that the ideal ratio of boys to girls fell within the fairly narrow range of 1.42 to 1.59 despite the fact that the total number of ideal children wanted varied between 2.7 and 4.4. Moreover, there were no large or consistent differences between rural areas, small cities, and large cities. However, this lack of differentials should not be taken as proof that son preference has remained the same over time. Although few of the studies reviewed provide detailed information at the couple level, it may be speculated that the lack of change is due to two opposing forces: a decrease in total ideal family size and an increase in the proportion of couples who want an equal number of sons and daughters.

This statistical quirk occurs because most Korean couples want an equal number of sons and daughters or one more son. Mathematically, the ratio of boys to girls in an ideal family rises from 1.5 for couples who want three boys and two girls to 2.0 for couples who want two boys and one girl. Thus, it may be argued that the natural tendency for this proportion to rise as ideal family size decreases has undoubtedly been offset by a fall in the proportion of couples who want more boys than girls. In the 1976 VOC study, for example, 43 percent of all men and women said the number of boys in their ideal family would exceed the number of girls by one; however, half of all respondents wanted an equal number of boys and girls, and hence did not exhibit any sex preference according to this measure.

Because of the problems inherent in comparing sex preference at different levels of ideal family size, Coombs developed a sex preference measure, based on unfolding theory, that is independent of number preference (Coombs et al., 1975). The Coombs IS-scale ranges from 1, which indicates extreme girl preference, to 7, which indicates extreme boy preference, with the neutral value of 4 indicating the absence of any sex preference. In the VOC study, the mean IS-scale score was 5.31 for married men and 5.30 for married women, almost identical with the average score of 5.37 reported in the KNFS (Kim and Choi, 1981). Over 90 percent of both men and women had scores of 5 or more, indicating the presence of son preference. In contrast, only 2 percent of men and 4 percent of women exhibited any amount of daughter preference (Bulatao et al., 1978).

As in most countries, sex preference is particularly prominent in reference to the first birth. According to the KNFS, 60.3 percent of currently married, fecund, nonpregnant Korean women want a boy for their first child, compared to only 4.1 percent who want a girl. At all parities, 66 percent of women want a boy for their next child, while only 16 percent want a girl (Korea, NBOS and KIFP, 1977:112). Table 25 shows that virtually no one with an equal number of boys and girls (or more girls than boys) expressed a desire to have a daughter for their next child. Families with more sons than daughters show a preference for an additional daughter; however, this preference is only moderate, except for families with two sons and no daughters.

When faced with the dilemma of what they would do if they did not have a son, some couples would go to rather

TABLE 25 Desired Sex of Next Child Among Currently Married, Fecund, Nonpregnant Women Who Want a Future Birth, 1974: Republic of Korea

Number of Living Daughters	Number of Living Sons		
	0	1	2
0	S= 60.3 D= 4.1	S= 25.9 D= 38.6	S= 1.8 D= 91.1
1	S= 93.5 D= 0	S= 80.0 D= 1.0	S= 23.1 D= 30.8
2	S=100.0 D= 0	S=100.0 D= 0	S= 71.4 D= 0

S = percent who want a son.
D = percent who want a daughter.

Source: Korea, NBOS and KIFP (1977:T353-T355).

extreme measures. In the 1971 study by the Korean Institute for Research in the Behavioral Sciences (Chung et al., 1972), 53 percent of respondents said they would just keep on having children no matter how many they had until they got a son (and this figure rose to 73 percent in rural areas). In more recent surveys, this percent has decreased considerably as ideal family size has declined, but a substantial proportion still say they would keep trying for a son. Another alternative would be to adopt a son into the family; this solution was preferred by the majority of household heads interviewed by Yoon (1974) in 1971. A more drastic solution would be for the husband to take a concubine to try to have a son. Concubinage was outlawed under Japanese rule in 1923 and is now rare; nevertheless, in three early studies, a substantial proportion of women (25 to 50 percent) said that if sonless, they would allow their husbands to take a concubine to have a son (Chung et al., 1972; H.-J. Lee, 1959; W.K. Koh et al., 1963). Although it is not likely that many women would actually do this, the large number who said they would underscores the importance of son preference at that time.

The majority of women still maintain that they must have a son (this figure has stayed constant at just over 60 percent for the last 10 years); however, the proportion of women who say they do not care whether they have a son or not increased from 16 percent in 1971 to about 30 percent in 1976 (Moon et al., 1973; B.T. Park et al., 1979). These data indicate that "the traditional preference for sons is still very much alive," although "that the traditional attitude has also undergone some erosion" (Cho et al., 1977:117).

Another indicator of son preference is the reported sex ratio of births and of children. Both the registration system and several surveys and censuses in Korea have found the reported sex ratio to be exceptionally high: the sex ratio of registered births was reported to be in the range of 106 to 116 in the colonial period and 105 to 125 since that time (Kwon, 1977); the censuses of 1955, 1960, and 1970 found the sex ratio of the enumerated population to be 105.5 to 107.2 at ages 0-4 and 107.6 to 109.1 at ages 5-9 (United Nations, ESCAP, 1975:39). However, there is evidence that the true sex ratio at birth does fall within the normal range; thus the above figures suggest an underenumeration of female children relative to male children and provide one more indication of the relative importance of males and females.

Even more revealing than the overall sex ratio of children is the breakdown of sex ratios by parity and birth order. For the KNFS, C.B. Park (1981) reported a sex ratio of 106.5 for all children, but the sex ratio in small families was considerably higher than that in large families. For example, it was reported to be 126 in two-child families and 130 in three-child families, but only 102 in five-child families and 94 in larger families. In addition, the sex ratio of the last child in families of any size (133) was markedly higher than that of previous children (101).

Because of Korea's high degree of son preference, the family planning program has spearheaded a campaign to modify sex preference attitudes by adopting the slogan "Stop at two, without sex distinction." This slogan has met with some resistance, however, as evidenced by the results of the most recent national family planning (IEC) (information, education, and communication) survey (Cheong et al., 1979). While three fourths of the men and women interviewed approved of the slogan "stop at two," only just over half approved of adding "without sex distinction." Moreover, there was about an equal difference in

acceptance of the two slogans in large cities, small cities, and rural areas, indicating that resistance is widespread rather than localized.

Whether son preference has begun to lose its firm hold on Korean society (as suggested by Cha, 1979, and Korea, NBOS and KIFP, 1977) or has waned very little during the last two decades (as suggested by Kwon and Lee, 1976, and Kwon, 1982), there is no doubt that the majority of Koreans maintain their traditional values on this subject. This is true in both urban and rural areas, among both young and old couples, and among both men and women, although several studies have found differentials by type of place of residence, degree of economic development, and age. It is still not clear whether the more modern sex preference attitudes adopted by some Koreans will diffuse rapidly through the population, as have modern family planning attitudes, or whether they will remain stubbornly resistant to change.

The Value of Sons and Daughters

The earlier discussion of the value of children dealt primarily with children in general. However, Korean parents do attach different values to sons and daughters and have different expectations for them. Sons are seen as entailing more benefits and fewer costs. They are essential for carrying on the family name, as well as for providing old age and other support, and ancestor worship (Cheong et al., 1979; Lee and Kim, 1979; Kong and Cha, 1974; Chung et al., 1974; Yoon, 1974; Bulatao, 1979). Although the financial concerns are important, continuing the family name or the family lineage is always the paramount reason given for wanting sons.

Daughters, on the other hand, are valued primarily for companionship and other psychological satisfactions while they remain in the family (Lee and Kim, 1979). Once they get married, they invariably leave their parents' household, and many of these advantages are lost, although they might still provide help in old age or emergencies. Not only are daughters seen as providing fewer benefits to their parents, but they are also seen as being more of a financial burden. Two recent studies have found that about twice as many parents think daughters cost more than sons as vice versa (N.H. Cho et al., 1977; Bulatao et al., 1978). Those who feel that daughters cost more say they need more expensive clothes, while those who

feel that sons cost more mention educational costs most often. Given these perceptions of costs and benefits, it is no wonder that son preference attitudes are slow to change.

The Effect of Son Preference on Fertility and Family Planning

The prevalence of son preference has been said to constitute "a major obstacle to reducing fertility" and "one of the most important obstacles to the current efforts of reducing fertility to near replacement level in Korea" (S. Hong, 1978:85; Kwon and Lee, 1976:2). However, the evidence does not uniformly support this contention, and the general consensus on the impact of son preference on fertility has recently begun to lose ground.

Kong and Cha (1974), in their review of 20 empirical studies conducted before 1975, found several studies showing that the sex composition of children affects the rate of contraceptive practice. More recently, Rindfuss et al. (1982) and Nemeth (1981) have presented some preliminary evidence that Korean women without any sons intentionally curtail breastfeeding to speed up the birth of the next child. Some of the strongest evidence for the influence of son preference on fertility comes from parity progression ratios and other measures based on family composition. This effect often manifests itself most strongly at the second and third parity. Chung et al. (1974) found many more families with three boys and with two boys and one girl than would be expected from probability theory, and many fewer three-child families with more girls than boys. The VOC study reported that there were nearly twice as many two-child couples with two boys as with two girls (Bulatao et al., 1978), indicating that couples whose first two children are girls are at least twice as likely to have more children as those whose first two children are boys. Additional evidence comes from the stated intentions of those with various family compositions. Table 26 shows the percent of women who want no more children, broken down according to their current number of living daughters and sons. The most striking differences appear at the second and third parities, where more than twice as many women with all boys than with all girls want to stop childbearing.

TABLE 26 Percent of Currently Married, Fecund, Nonpregnant Women Who Want No More Children, by Number of Living Daughters and Sons, 1974: Republic of Korea

Number of Living Daughters	Number of Living Sons						
	0	1	2	3	4	5+	All
0	13	16	77	94	(100)	(96)	51
1	12	71	97	99	100	(100)	74
2	36	82	98	99	(100)	*	86
3	47	81	99	100	(100)	*	87
4	(55)	81	99	(100)	*	*	86
5+	*	93	(100)	*	*	*	88
All	23	64	94	98	100	99	74

(): Less than 50 cases.
*: Less than 20 cases.

Source: Korea, NBOS and KIFP (1977:112).

While these differences are indeed dramatic, the overall effect of gender preference is attenuated by the fact that by biological necessity, fewer women fall in the extremes of having all boys or all girls than fall in the middle where the differences are considerably smaller. There are also large numbers of women at parities 0, 1, and 4 or higher, where sex preference is less important.

To calculate the overall effect of gender preference, a new measure can be used which attempts to estimate fertility attitudes in the absence of any gender preference. This measure assumes that without any sex preference, all women at any given parity will be as satisfied with their family size as are those of the same parity who currently have the most favored combination of sons and daughters. In other words, it may be hypothesized that 16 percent of all women with one child will want no more children, 77 percent at parity two, 97 percent at parity three, and so on (see Table 26). This measure also allows for the presence of daughter preference or a preference for balance. Using this method and the KNFS data in Table 26, it may be estimated that 80.4 percent of Korean women would want no more children in the absence of any gender preference, compared to 74.3 percent who actually said they wanted no more children. The same method leads to a somewhat larger differential in the case of contraceptive use: 54.6 percent of women would use contraception in

the absence of any gender preference, compared to 45.7 percent who said they were actually using contraception at the time of the survey. These rough measures indicate that gender preference may play a considerable role in explaining fertility behavior in Korea. However, it is equally obvious that strong sex preference attitudes have not kept large numbers of women with an "undesirable" balance of daughters and sons from using family planning to curtail further childbearing.

Multiple regression analyses of the influence of sex preference on fertility and family planning yield mixed results. The Survey of Economic Factors in Fertility found that son preference exerted a strong influence on the number of children desired, but no significant influence on contraceptive use. Koo (1979) found that son preference was statistically significant in explaining fertility for older urban respondents only. Chung et al. (1974) concluded that boy preference was an important factor in family planning practice up to parity four (particularly at the intermediate parities, thereby paralleling the results based on family composition); however, the authors did not find any net effect of boy preference on the desire for more children among low-parity women. Overall, the multivariate analyses indicate that although son preference has an impact on fertility for women in some groups, its effect is decidedly less consequential than the purely descriptive data on son preference might lead one to believe.

Kwon (1982) attributes the relatively weak effect of son preference to countervailing forces. He speculates that son preference will cause some couples to have more children than they would otherwise desire, but others to have fewer children because girls are not considered an absolute necessity for Korean families; therefore, the net effect of son preference on the aggregate level is negligible.[6] Kwon et al. (1975) have also put forth the intriguing thesis that historically, son preference may have lowered the rate of population growth in Korea by generating relatively high mortality for adult women and female children through inadequate care and diet. The argument that gender preference does not necessarily retard fertility decline has also been developed in two recent studies outside of Korea. In a small empirical study in the United States, Widmer et al. (1981) showed that sex preference can lead to lower fertility for some couples and that the overall effect of sex preference is not necessarily an increase in fertility. Bulatao and

Fawcett (1981) suggest that fertility may be reduced by the existence of gender preference because of the risk that the next child may be of the "wrong" sex. In Korea, this possibility cannot be discounted.

An alternative hypothesis would suggest that son preference may become a more important element in the future course of Korean fertility. According to this argument, son preference has a negligible effect on fertility when the TFR is at a level of five or six children, but will gain in importance as the TFR approaches a level of two or three children. In this case, further substantial reductions in fertility would be unlikely without major changes in the social and cultural values that support son preference attitudes.

There are thus a number of opposing arguments and very little empirical research on the present and future effects of son preference on fertility. This topic must therefore remain a matter for speculation.

NOTES

1 In some surveys, respondents were asked the ideal number of children for women in Korea; in others, they were asked for their personal ideal or desires; and in others, the precise nature of the question was not clear.
2 A detailed discussion of gender preference for children is presented in the next section.
3 The results of the Survey of Economic Factors in Fertility cited here and in the remainder of this chapter are found in N.H. Cho et al. (1977).
4 It should be noted that women are particularly concerned with the issue of old age security (Lee and Kim, 1979) since they are generally younger than their husbands, and their life expectancy is considerably higher; therefore, they can expect to live for many years after their spouse's death.
5 Costs may be felt more acutely at higher parities because personal tax exemptions are limited to the first two children; however, this factor would only be important for couples who pay an income tax.
6 See Chapter 4 for a more detailed explanation of this thesis.

CHAPTER 6

FAMILY PLANNING AND ABORTION

DEVELOPMENT OF THE NATIONAL FAMILY PLANNING PROGRAM

The major social changes in Korea that have been linked to the modernization process and industrialization brought about a transformation in the value of children. Individual couples began to appreciate the benefits of having small families and the government began to realize the need for a reduction in the rate of population growth. These perceptions prompted the development of a major national family planning program and led to its early success. This chapter begins with a review of the historical development of the national family planning program and past and present trends in contraceptive use. The chapter concludes with a discussion of the use of induced abortion and its impact on fertility rates.

As discussed in Chapter 1, the late 1950s were years of very high fertility. This period was preceded by a series of important political events: in April 1960, there were massive student protests that eventually led to the overthrow of the Rhee government and the establishment of an interim government. A new government, formed a few months later, undertook a major national development program. The so-called National Reconstruction Movement peaked in 1962-63, when over half of the roads to rural villages were improved and clubs were organized for women aged 19-45 in each of the 45,000 villages in the country. The new government also began to evince an interest in family planning. This interest was strengthened in early

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This chapter is based on a number of reports describing the family planning program in Korea, especially the history by Kim et al. (1972).

1961 when it was announced that the gross national product had increased by only 2.6 percent the previous year, while the population growth rate (based on 1960 census results) was a whopping 2.9 percent, more than enough to cancel the small economic gain. Private-sector family planning efforts also helped stimulate the interest of both the government and civic leaders.

The Planned Parenthood Federation of Korea (PPFK) was founded in the spring of 1961 following contacts with the International Planned Parenthood Federation (IPPF) at international meetings, through IPPF's publications, and through visits of IPPF personnel. The head of the National Reconstruction Movement became president of PPFK. Since its formation, PPFK has worked closely with and has been subsidized by the Korean government, coping with politically sensitive family planning issues and occasionally shielding the government from criticism. It has also played an important international role in population and family planning.

PPFK was also instrumental in the establishment of Korea's national family planning program in 1962. When this program began, the local health infrastructure was quite weak, and there was no established health network below the gun (county) level. The government did not complete its goal of establishing one health center in every shi (city) and gun until 1963. When myun (township) family planning workers were finally hired in 1964, they were put under the myun chief in the regular government office rather than under the health administration. This system had the unexpected advantage of making the myun chief responsible for the success of the family planning program, but it had the disadvantage that the family planning worker's role was usually diluted with other work in the myun office. Nevertheless, efforts were made to minimize the size of the central organization, and most of the money for the program was distributed at the local level.

When the family planning program was first established, it offered only traditional contraceptive methods and vasectomy. A major expansion was facilitated by the inclusion of family planning expenditures in the investment section of the national budget in 1963. At the end of the same year, the program was extended to provide a family planning worker for each of the country's 1,473 myun, and a mass IUD program was announced. On this basis, the government set a target of reducing the population growth rate from 2.8 to 2.0 percent annually

by 1970. In a single year, the number of family planning field workers increased from 366 to 2,970, and the annual number of loop insertions increased from 2,000 to 107,000; by 1967 the program had inserted its millionth loop (Cho and Perry, 1979:103). The number of physicians who completed the basic training course in family planning each year rose from 45 in 1962 to 1,154 in 1964, then gradually tapered off (Korean Institute for Family Planning, 1978:367).

By 1964, 18 percent of the government's total health budget was allocated for family planning. This rose to 30 percent in 1966 before it began to decline, reaching a level of only 13 percent by 1970. In the first six years of the program, foreign assistance accounted for 18 percent of total family planning expenditures by the government and by PPFK. Most of the local funds were spent for organizational activities and contraceptive supplies; most of the foreign funds were spent on demonstration projects, equipment, research, evaluation, training, and information and education.

The largest foreign donors during the 1960s were IPPF and the Population Council. After 1967, the United States Agency for International Development (USAID) began to provide large-scale support to Korea's family-planning programs. In addition, the Swedish International Development Agency (SIDA) contributed substantial funds to build the Korean Institute for Family Planning's modern training and research facilities. As a consequence, mainly of USAID and SIDA funding, the foreign share of total family planning rose to about 40 percent around 1970.

The Ministry of Health and Social Affairs (MOHSA), which administers the family planning program, gave PPFK responsibility for the national information and education campaign during the 1960s; it gave KIFP the task of training family planning personnel, and conducting research and experiments. In 1963, 125,000 posters and 2.3 million calendars were distributed in rural areas. The following year, posters and calendars were supplemented by about 1.5 million leaflets on contraceptive methods and 400,000 counter cards for restaurants. Flip charts and pelvic models were also distributed for use as educational aids. In 1965, even more innovative items such as fans for family planning acceptors and mirrors with loop messages for beauty shops were introduced. The thrust of the program began to change in 1966 with the introduction of mobile teams consisting of a health educator and a family planning worker. These teams

conducted group meetings and showed informational films in villages, in addition to providing clinical services. Both group meetings and media messages have been invaluable for spreading family planning information and motivating acceptors. In 1968, the monthly magazine Happy Home was started for the members of 17,000 Mothers Clubs that were set up that year (see the next section for a fuller discussion of these clubs). Since the beginning of the family planning program, both government and private radio stations have carried a substantial amount of family planning material. Discussion sessions have been broadcast, and the availability of contraceptive methods has been publicized through spot announcements. At the present time, there continue to be spot announcements every other day, plus special programs from time to time.

Although PPFK and MOHSA have been most active in the family planning program over the years, other agencies have also played important roles. The Ministry of Home Affairs, through the local government organizations and later the New Village Movement (Saemaul Undong), mobilized support for family planning; the Ministry of Culture and Public Information contributed to the success of media campaigns; and the Ministry of Education was instrumental in the introduction and expansion of population education activities. Finally, the army has provided family planning education to large numbers of military personnel.

MOTHERS CLUBS

In 1968, the Planned Parenthood Federation decided to establish "Mothers Clubs" in rural areas, basically to overcome traditional resistance to both smaller-size families and modern contraceptive practice. From the beginning, these clubs were planned only for rural areas, principally because of (1) the socially cohesive informal networks that have traditionally bound families and individuals in the villages; and (2) social institutions, based on traditional values, that have resisted radical social change in these areas. The idea was to promote family planning in the conservative rural sector by making use of the existing informal networks of married women. Urban areas generally had much greater access to contraceptives through both commercial channels and city health centers; moreover, urban women, having lower fertility levels and better education, were already more

highly motivated to accept family planning. Furthermore, the informal networks existing in the villages did not exist in urban areas.

The stated objectives of the Mothers Clubs were to motivate village women to accept and practice family planning, to facilitate family planning communication, and to mobilize support for the government's population policy. For tactical reasons, they also engaged in such related activities as health education for better sanitation, small-scale banking functions, and neighborhood assistance projects.

At the time the clubs were formed, there were roughly 16,800 legal villages in Korea, with one legal village usually consisting of several natural villages. In 1973, there were some 22,500 clubs; during the peak of Mothers Clubs activity, they were operated by about half of the natural villages. The clubs ranged in size from 12 to over 40 members; as they became more active, they gradually grew larger, with the average club size increasing from 23 in 1968 to 31 in 1972. The clubs met about once a month, and according to a 1974 survey, had an overall attendance of about 76 percent (H.J. Park et al., 1974:177-182). The survey also showed that 10 percent of the clubs were very active, 38 percent active, 37 percent were moderately active, and 15 percent inactive; in other words, about one half were functioning productively.

It is extremely difficult to evaluate quantitatively the contribution of these clubs to the success of the family planning program and to actual fertility reduction in Korea, although such attempts have been made. For example, Park and Chung estimated that roughly 33 percent of couples practicing family planning in 1974 did so on the advice of the Mothers Clubs (H.J. Park et al. 1974:191). Where they were actively functioning, the clubs effectively recruited new acceptors, provided valuable assistance in introducing and winning acceptance of new contraceptive methods, and contributed to continued use by serving frequently as convenient, additional distributors of such contraceptives as pills and condoms. They also provided important channels for information and education about family planning. At the community level, club leaders encouraged village leaders to participate in family planning activities.

In the initial stages of the family planning program, field workers in the rural communities played a fairly effective role; in subsequent years, however, they tended

to be younger and unmarried and to show high turnover. The Mothers Clubs, composed of older, married women, provided social and psychological support to these workers and to family planning acceptors. The clubs also helped eliminate taboos against discussing sex and family planning, and contributed indirectly to improving women's status giving them more active community roles and leadership.

The Mothers Clubs existed and operated for 10 years beginning in 1968, after which they were integrated into the nationwide "Saemaul," or new Village Movement. This movement, still actively operating, is a comprehensive effort toward developing and modernizing the rural sector of the country (for further discussion, see M.-G. Lee, 1980). By 1978, a major decline in fertility had been achieved, as discussed in Chapter 2. Whether or not the Korean family planning program would have achieved the high level of contraceptive practice without the Mothers Clubs is a moot question. Certainly, the clubs were an important factor in the success of the Korean family planning program, and consequently in the reduction of marital fertility.

TRENDS IN CONTRACEPTIVE PRACTICE

The expansion of the government's family planning program was followed by a major increase in contraceptive practice. Table 27 shows contraceptive practice rates by women's age and residence for 1966, 1971, 1976, and 1979. The last column of the table indicates that the practice rate increased 2.7 times in 13 years, from 20 to 54 percent of currently married women age 15-44. The urban practice rate was four to eight percentage points higher than the rural practice rate between 1966 and 1976, but only one percentage point higher in 1979, indicating a rapid urban-rural convergence between 1976 and 1979. Table 27 and Figure 8 also show that practice rates increased substantially at all ages, but especially at ages 30 and above. For the country as a whole in 1979, the practice rate ranged from 18 percent at ages 20-24 to 72 percent at ages 35-39. The practice rate at ages 40-44 was lower than that at ages 35-39, perhaps partly because some women feel they are not able to have more children at this age and hence do not use contraception.

TABLE 27 Contraceptive Practice Rates by Woman's Age and Residence, 1966-79 (percent of currently married women): Republic of Korea

Residence and Date	Age 20-24	25-29	30-34	35-39	40-44	Total
Whole Country						
1966	3	13	29	32	14	20
1971	7	15	28	38	27	25
1976	15	32	56	62	45	44
1979	18	41	68	72	53	54
Urban						
1966	5	19	36	33	13	26
1971	7	17	32	45	29	27
1976	18	37	60	66	48	48
1979	19	43	69	72	55	55
Rural						
1966	3	10	25	30	15	18
1971	5	14	24	34	25	23
1976	12	25	50	57	44	40
1979	16	36	67	72	51	54

Note: The last column refers to currently married women aged 15-44. For 1971, 1976, and 1979, the 20-24 age group includes currently married women aged 15-19.

Sources: Korean Institute for Family Planning (1978:313); K.S. Koh et al. (1980b:106).

Table 28 presents contraceptive practice rates by women's education and residence. It is noteworthy that by 1966, college-educated women were already modern in their contraceptive behavior. Indeed, their practice rate of 46 percent in 1976 was slightly lower than it was in 1966. This decline occurred because of the increase in the proportion of college-educated women who lived in rural areas and had lower practice rates than their urban counterparts; practice rates for urban college-educated women increased slightly over the decade. In 1966, practice rates increased steeply and monotonically with education, but from 1971, a contraction of educational differentials began to take place. In 1976, practice rates were very similar from one educational group to the next, although those with a high school or college education still tended to have higher rates than those

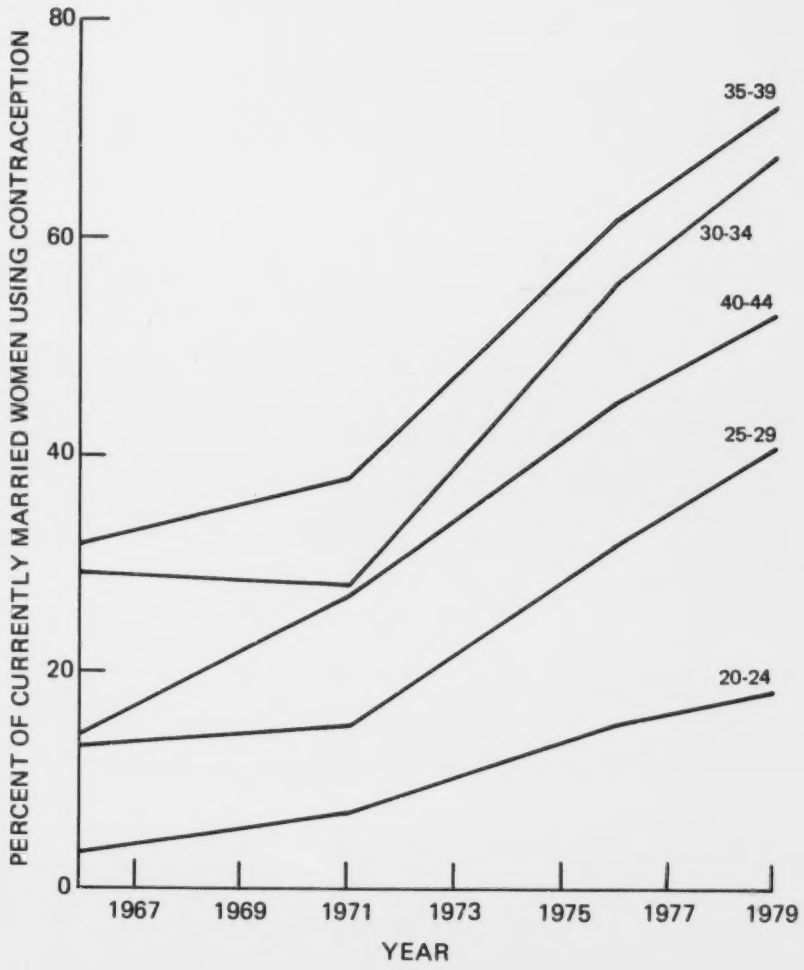

FIGURE 8 Contraceptive Practice Rates by Woman's Age: Republic of Korea

with less education. The patterns of urban-rural differences in practice rates within educational categories did not change much over the 13-year period; the gradual disappearance over time of educational differentials was taking place both in urban and rural areas.

The almost complete disappearance of rural-urban differentials in contraceptive practice by 1980 can be credited to the wisdom of the early program leaders and administrators in focusing their efforts on the traditionally high-fertility rural areas. Program

TABLE 28 Contraceptive Practice Rates by Women's Education and Residence (percent of currently married women aged 15-44) 1966-79: Republic of Korea

Residence and Date	Education				
	None	Primary	Junior High	High School	College
Whole Country					
1966	16	20	32	40	49
1971	21	25	25	32	38
1976	38	41	41	46	46
1979	51	54	53	58	61
Urban					
1966	14	23	36	40	51
1971	19	27	24	35	36
1976	41	46	47	54	53
1979	52	54	53	59	61
Rural					
1966	16	18	26	43	--
1971	21	23	25	21	44
1976	39	41	38	40	44
1979	51	55	53	52	62

Sources: Korean Institute for Family Planning (1978:315). The values of 16, 14, and 16 for 1966 in the first column are approximate values obtained by averaging practice rates for "illiterate" and "read Korean" in Korea, Ministry of Health and Social Affairs (1966:163) (the figures in the KIFP source are erroneous).

administrators argued that contraceptive needs in urban areas would be met by the private sector. Changing patterns in contraceptive sources in rural and urban areas support this argument. The proportion of users obtaining contraception from the government program has gradually declined: in 1966, 80 percent of current users obtained contraceptives from the government program, while in 1976, this figure was only 50 percent (Korean Institute for Family Planning, 1978:313). The expansion of nongovernment services has occurred principally in urban areas, largely because drug store contraceptive purchases involve no filling out of forms or lengthy waits and usually no prescription; rising incomes, making contraceptive costs less burdensome, together with the rather small price differences between government and nongovernment contraceptives, have also contributed to

the increased use of the latter. Since 1976, the proportion obtaining contraceptives from the government may have risen somewhat because of the increased subsidy of sterilization, which will be discussed later.

USE OF DIFFERENT CONTRACEPTIVE METHODS

Table 29 shows contraceptive practice rates by method. In 1966, the most popular method was the IUD, followed by the condom; however, virtually all of the increases in practice between 1966 and 1976 are accounted for by other methods--the pill, sterilization, and "other" (e.g., diaphragm, spermacides, douche, rhythm, withdrawal). The

TABLE 29 Contraceptive Practice Rates by Method of Contraception and Residence (percent of currently married women aged 15-44), 1966-79: Republic of Korea

Residence and Date	Method				
	IUD	Pill	Condom	Steril-ization	Other
Whole Country					
1966	9	1	6	2	2
1971	7	7	3	4	4
1976	11	8	6	8	11
1979	10	7	5	20	12
Urban					
1966	9	1	9	3	4
1971	5	7	4	4	7
1976	8	8	8	11	13
1979	6	6	6	24	13
Rural					
1966	9	0	5	2	1
1971	8	7	2	3	3
1976	13	8	4	6	9
1979	15	8	4	16	11

Note: Sterilization figures include male as well as female sterilizations. Method-specific rates in this table add, to within small rounding errors, to overall practice rates in the last column of Table 6.1.

Source: Korean Institute for Family Planning (1978:316).

IUD practice rate actually declined in urban areas, although it increased in rural areas and remained approximately constant in the country as a whole.

As noted above, the IUD was greatly emphasized from the beginning of the national family planning program; it was the only effective method known to the program administrators and leaders. The major push for IUD acceptance was in rural areas, as is reflected in Table 29. The argument behind this emphasis on IUD acceptance was that the level of education among eligible women in rural areas was low, and the method was rather simple to administer: it did not require the services of medical doctors, and individual acceptance and practice were easily achieved without much educational effort.

In the early stages of the family planning program in 1963-64, IUDs were introduced on a large scale and were rather favorably accepted. Nevertheless, there was some cultural resistance. In his study of fertility in a rural community in 1964, Cho (1966) found that not all the villages in the area accepted IUDs. Villages with effective leaders who were younger and had a modern outlook were more accepting, but villages under conservative leadership resisted. Eventually, of course, all rural areas came to adopt IUDs as a principal contraceptive method. Acceptance of the IUD also meant a serious decision by the individual to control births. The IUD drop-out rate was very high during the 1970s, reaching 51 percent by the end of the first year (Moon and Han, 1973). However, IUDs played the important role of initiating contraceptive behavior in addition to preventing births; IUD drop-out was usually followed by either abortion or adoption of other contraceptive methods.

The government program did not introduce birth control pills on a large scale until 1968; by then, IUD drop-outs were increasing, and couples were searching for an alternative method other than abortion. As shown in Table 29, use of the pill increased at approximately the same rate in both rural and urban areas. Another noticeable change in the trend of contraceptive practice since 1976 is the rapid increase in the use of other methods, such as withdrawal and rhythm, in both rural and urban areas.

It is not apparent in the table, but the upsurge in sterilization, which was particularly marked in urban areas, occurred only after 1972. Before that date, sterilizations were limited mainly to vasectomies, and the number of female sterilizations was negligible. A dramatic surge in the latter occurred in the two-year

period 1975-77, with the rate rising from 11 to 53 tubal ligations per 1,000 ever-married women age 20-39. This increase has been attributed to the introduction of laparoscopy (a simplified outpatient procedure) into the government program in 1976 and the tripling of government payments in 1977 from 5,000 to 15,000 won (U.S. $10 to U.S. $30) to physicians performing the procedure. Prior to 1977, the government subsidy covered only one third of the fee, leaving the patient to pay the other two thirds. In 1976, the proportion of couples sterilized in the private sector exceeded the proportion sterilized in the government sector; by 1978, this differential had been reversed (Westoff et al., 1980:130-137).

The female sterilization rate increased substantially in both rural and urban areas at every age and marital duration and at every parity and educational level. Perhaps because of the increases in the government subsidy, however, the greatest surge in female sterilization occurred at lower educational (and, presumably, income) levels; the sterilization rate did not increase much for college-educated women (Westoff et al., 1980:137). The surge was also notable among those who had never previously used contraception: in 1977, female sterilization accounted for 22 percent of all new acceptors in the government program (Korean Institute for Family Planning, 1978:291). Since 1977, two-child families with a wife under 40 who has undergone contraceptive sterilization are given preference for new government housing (Nortman and Hofstatter, 1980:23), although the import of this policy has yet to be evaluated.

Among currently married fecund women who want no more births (the group that is most likely to elect sterilization), 26 percent were sterilized as of 1978. Another 29 percent were using other efficient methods (pill, IUD, condom, diaphragm, spermicides). The remaining 45 percent were either using inefficient methods (rhythm, withdrawal, douche, and folk methods) or were not using contraception at all (Westoff et al., 1980:137). Many of these women used abortion, which will be discussed later in this chapter. Because of the widespread use of abortion, the substantial increase in sterilization after 1976 averted only a moderate number of births. In 1977-78, sterilization averted 0.84 pregnancies per woman, of which 0.30 would have resulted in births and 0.54 in induced abortions. The sterilization program has thus had a major impact in reducing the number of abortions (Westoff et al., 1980).

Direct computation of births averted indicates that the national family planning program accounted for about 37 percent of the decline in the birth rate for women aged 15-44 between 1963 and 1973. The effect of the program was largest (in the neighborhood of 54 to 60 percent) at ages 25-44; at ages below 25, rising age at marriage accounted for most of the fertility change (Khoo and Park, 1978:70). This estimate of impact is approximate, since it depends somewhat on educated guesses about potential fertility and substitution rates. Regarding the latter, it was assumed that 20 percent of acceptors in the government program would have obtained contraception in the private sector had the government program not been available.

Multivariate areal analyses also indicate that the national family planning program contributed to fertility decline. Standardized regression coefficients indicate that both the program and socioeconomic changes have contributed; however, results from such studies depend a great deal on which variables are included in the analysis. Cho and Perry (1979:110) found that the availability of pharmacies strongly influenced total marital fertility in 1970, more so than did the IUD acceptance rate. K.S. Koh et al. (1980a:21) found that availability of doctors and family planning workers (variables not included in Cho and Perry's analysis) substantially influenced the TFR in 1975.

In spite of Korea's lowered fertility rates, the absolute number of births could increase as women born during the "baby boom" of the late 1950s enter the high-fertility age group. To forestall this, the government established a Population Policy Deliberation Committee in 1976, chaired by the Deputy Premier and Economic Planning Minister. Beginning in 1977, a revision of the income tax law limited tax exemptions to two rather than three children per family. Operationally, the family planning program has increased field workers' salaries, and plans are underway to increase services to special groups such as industrial workers and the very poor (Nortman and Hofstatter, 1980:23).

The new government under President Chun decided to continue to push the family planning program, and recently legislated an incentive scheme to discourage large families. According to this new scheme, to be implemented from 1982, families with three or more children will have to pay a higher residence tax and higher fees for medical insurance. Other benefits for

small families include priority in public housing, maternal leave for public-sector employees, and maternal medical service benefits. Also, as noted above, to counter the persistent preference for sons, new legislation has been proposed to attempt to correct those aspects of the inheritance system that are unfavorable to women.

The target in the Fourth Five-Year Plan was to reach an annual growth rate of 1.6 percent by the end of 1981. However, results from the 1980 census show that the average annual growth rate between 1975 and 1980 was 1.5 percent (see Table 1), and the target was thus already achieved by 1980. So far, moreover, the resurgence of births has failed to materialize.

The Fifth Five-Year Plan calls for continued family planning efforts and further reduction in the population growth rate. Because the proportion of women of childbearing age will substantially increase in the years to come, the Plan sets a fairly realistic target of a 1.5 percent growth rate for 1986. If this is to be achieved, the family planning practice rate must increase to 56 percent by 1982 and 67 percent by 1986.

INDUCED ABORTION

In recent years, populations with a so-called Chinese cultural background have been successful in reducing their fertility levels, usually at a more rapid rate than European populations. These frequently cited "family planning success stories" occurred first in Japan and then in other East Asian nations, and in the Chinese populations of Singapore and Malaysia. All these populations have historically been under the influence of the Chinese culture, for which induced abortion and infanticide were traditional practices. In the absence of modern contraceptives, it is considered quite natural for a woman to resort to abortion to terminate an unwanted pregnancy. This happened on a massive scale in Japan after World War II. As modern contraceptive methods are introduced, the use of abortion as a method of birth control becomes less prevalent, but it never completely disappears. Abortion in these populations still serves as the ultimate means of birth control when other, more convenient methods fail, and this is particularly true in Korea. Asian cultures which sanction induced abortion or infanticide will probably complete the fertility transition more quickly than those which do not; consequently,

among the former, abortion tends to play a major role in the initial stage of the fertility transition (Cho, 1977).

THE PREVALENCE OF INDUCED ABORTION

Although detailed statistical information on abortion is scarce and tends to be incomplete, it can be said that induced abortion has been an important means of family-size control and thus a major intermediate determinant of Korean fertility levels, at least since 1960. Before the initiation of the national family planning program in 1962, it was the only effective method of fertility control. However, induced abortion is known to have been very rare during the period of Japanese colonialism. A small black market in abortions arose immediately following the liberation of Korea in 1945, and an increasing number of "backyard" abortions were performed during and after the Korean War (1950-53). Abortions occurred mainly in the cities, especially the large ones, on a very limited but growing scale (Caldwell, 1969). The major motivation for abortion at that time was to terminate illegitimate pregnancies resulting from forced or unavoidable situations during the period of war and extreme social unrest; because of such incidents, abortion became socially acceptable, though it remained illegal.

Various studies clearly indicate that induced abortion for family limitation started in the late 1950s and was rapidly diffused to a significant proportion of the urban population beginning around 1960. An early abortion survey in Seoul discloses that one abortion took place for every two births in 1963, and that more than 90 percent of abortions in the early 1960s were induced for the purpose of family limitation (S.B. Hong, 1971:20 and 47). According to an estimate by Han (1973:71-78), based on the 1971 National Fertility-Abortion Survey, the ratio of the total abortion rate to the TFR (approximately equivalent to the ratio of the total number of abortions to the total number of births) was 22 percent in Seoul, 18 percent in other urban areas, and 3 percent in rural areas.

Although self-reported data on abortions are known to be unreliable, there is considerable evidence that induced abortion has become more prevalent since 1960, except in the years around 1970. The proportion of ever-married women who had experienced an abortion was

TABLE 30 Percent of Ever-Married Women Who Have Experienced an Induced Abortion: Republic of Korea

Region	1966	1971	1976
Whole Country	13	26	39
Seoul	25	40	50
Other Urban	23	34	41
Rural	10	19	29

Sources: Han (1973:73); B.T. Park et al. (1979:147).

reported to be 13 percent for the whole country in 1966 and 39 percent in 1976, while the total abortion rate has been estimated at 550 per 1,000 ever-married women for 1960, 1,347 for 1966, and 2,310 for 1976 (see Tables 30 and 31). Such a drastic change in the prevalence of abortion has been accompanied by a concomitant change in attitudes: according to a survey in a middle-sized town, the proportion of women who disapproved of abortion was 54 percent in 1965 (Lee, 1965:20); national surveys of fertility and family planning show the rate of disapproval to be 45 percent for 1971 and only 8.5 percent for 1976 (B.T. Park et al., 1979:254).

Although abortion was illegal in Korea except for medical or maternal health reasons until 1973, legal action against abortion has rarely been taken, and a majority of the population has treated abortion, along with contraception, as a proper means of family limitation. One important factor contributing to this situation and thus to the high prevalence of abortion is a lack of opposition to illegal abortion among medical personnel and lawyers (Ham and Jon, 1965). More than 90 percent of abortions were reported to have been performed in authorized medical clinics even before legalization in 1973, at a cost so small that it did not constitute an economic strain even for the poor (Hong and Watson, 1976:95-96). In fact, the average cost for an abortion in 1971 was reported as U.S. $7.50, which was equivalent to three days' wages for unskilled laborers; the 1968 abortion survey in Seoul reported similar costs (S.-B. Hong, 1971:45-46).

TABLE 31 Total Induced Abortion Rates (per 1,000) by Type of Area, 1960-76: Republic of Korea

Year	Whole Country	Seoul	Other Urban	Rural
1960	550	1,184	1,001	249
1961	610	1,658	848	264
1962	748	1,562	906	468
1963	935	2,146	1,223	522
1964	992	1,878	1,342	632
1965	1,326	2,964	1,623	753
1966	1,347	2,764	1,653	830
1967	1,413	2,452	2,086	855
1968	1,430	2,430	2,087	899
1969	1,755	2,424	2,794	1,142
1970	1,652	2,004	2,446	1,200
1971	1,590	2,114	2,100	1,170
1976	2,310	2,720	2,430	1,890

Sources: Han (1973:73); B.T. Park et al. (1979:147).

In addition to a growing desire for family limitation and a low level of economic and social constraints, the rapid dissemination of abortion in the 1960s seems to have been partly due to the frequent failure of contraceptive methods and a widely prevailing distrust of both contraceptives and sterilization. Many studies on abortion reveal a close association between family planning practices and abortion (Hong and Watson, 1976:120-23; S.-U. Kim, 1980). For example, the proportion of contraceptive users among women with abortion experience was 76 percent in 1971, while that among women with no abortion experience was 33 percent. In a pregnancy-interval analysis based on the 1974 KNFS data, Choe (1980) demonstrates that women with abortion experience were generally "bad" contraceptive users as compared to women who relied on contraceptives only. It was found from various in-depth interviews (in the 1965 and 1974 Ichon surveys and in an anthropological survey of population processes in Korea by S.B. Han and others) that a considerable number of women preferred induced abortion to contraceptives or sterilization for family planning and had had multiple abortions, even though 95 percent of women still consider abortion to be hazarous to one's health (B.T. Park, et al., 1979:161). The proportion of ever-married women who had experienced

abortion more than once is reported to have been 7 percent for the entire nation in 1966, 13 percent in 1971, and 22 percent in 1976 (B.T. Park et al., 1979:147; Korean Institute for Family Planning, 1978:330). According to the 1976 National Fertility and Family Planning Evaluation Survey, the majority of women would abort a birth if it resulted from the failure of contraceptives or if it were unwanted (B.T. Park et al., 1979:159-60).

Table 31 shows that the abortion rate reached a plateau around 1970 and resurged in the mid-1970s. The plateau may be explained by the increasing availability of effective family planning methods after 1965, while the resurgence may be explained by the legalization of abortion for family limitation in May 1973, since which time the government has vigorously promoted abortion as an important component of the national family planning program.

PATTERNS AND DIFFERENTIALS OF ABORTION

As stated above, abortion became popular first in big cities, then in small cities, and finally in rural areas. The rate of abortion peaked in 1965-66 in Seoul and in 1969-70 in other cities, thereafter fluctuating with a tendency to decline, in the early 1970s (see Table 31). The rate for urban areas, including Seoul, rose again in the mid-1970s, although it had not quite reached its former peak levels by 1976.

A nearly incessant increase in the rate of abortion has been observed in rural areas since the early 1960s. As a result, the urban-rural gap in the prevalence of abortion was reduced gradually during the first half of the 1960s and rapidly after 1965. The rate of abortion in rural areas was estimated at about 20 percent of the urban rate in 1960 and 70 percent in 1976. The marked regional gap in the early years is largely accounted for by a scarcity of doctors and a relatively small abortion market; moreover, although various surveys found rural women more favorable to abortion than urban residents, the former apparently felt more anti-abortion pressure within the more intimate rural community. With the growing abortion market and increasing population pressure, rural women became increasingly exposed to abortion. The legalization of abortion in 1973 was particularly important in expanding rural abortion practices since the national family planning program was concentrated in these areas.

With the growing prevalence of abortion and the rapid decline of fertility, the first incidence of abortion for an individual woman started to take place at an increasingly early age and parity. For instance, the proportion of pregnancies that terminated in induced abortion in the third parity was 1 percent in 1960, 9 percent in 1965, and 11 percent in 1970 (Han, 1973:8). Overall, abortion is concentrated among women aged 30-39, with the degree of prevalence dropping toward both ends of the reproductive span, according to either the age-specific abortion rate or the ratio of abortions to live births (Korean Institute for Family Planning, 1978:334; Park, Choi & Kwon, 1979:152). The rising incidence of abortion in the early reproductive ages is usually interpreted as indicating the recent increased use of abortion for spacing between children.

According to a series of abortion surveys in Seoul, the relationship of an individual's socioeconomic background to abortion use changed significantly during the 1960s. In 1964, abortion was much more commonly practiced among women of higher socioeconomic status; there was a strong positive association between abortion and women's educational, occupational, and economic status. This pattern shifted partially in 1970: abortion became most extensive among middle-status women and decreased slightly in the upper-status group (S.-B. Hong, 1971:26-42); similar observations can be made based on national abortion data from a variety of sources compared in sequence (see Han, 1973:13-26; S.-U. Kim, 1980; B.T. Park et al., 1979:145-50).

Religious background has little association with abortion use; even Catholics have about the same level of use as women in other religious groups or those with no religion. Based on the 1974 KNFS data, S.-U. Kim observed that an extended family composition tends to be associated with somewhat less frequent abortion use, indicating the parental anti-abortion pressure due mainly to a difference between parents and children in desired family size. Lack of privacy may also act to discourage abortion.

From various surveys, very consistent differentials in attitudes toward abortion are observed by women's age, current residence, and other major socioeconomic background characteristics. However, these patterns are generally opposite to those observed for actual abortion behavior, and there is no significant statistical relationship evident between abortion behavior and attitudes (S.-U. Kim, 1980; Han, 1973:58). This

suggests that actual use largely depends on the couple's motivation to control family size and satisfaction with available family planning methods, rather than on their attitudes.

ABORTION AND THE PRACTICE OF FAMILY PLANNING

As mentioned above, abortion has been considered an important means of fertility control in Korean society since the late 1950s; it is also clear from the above discussion that abortion trends have been very positively correlated with family planning practices, indicating that abortion is not simply an alternative to contraceptives. Hong and Watson (1976:120-139) observed the following relationships between abortion and contraceptive use based on the 1971 National Fertility-Abortion Survey:

> The proportion of contraceptive users is much greater among women with abortion experience than among those without.
>
> Contraceptive use after abortion is more frequent than that prior to abortion, and abortion is more common among previous contraceptive users than among non-users. In general, the use of contraception and abortion stimulate each other.
>
> Sterilization and abortion are largely mutually exclusive. The proportion of women sterilized after abortion is very minor (12%), compared to the women who previously adopted contraceptives (27%).
>
> A considerable portion (42%) of women remain unprotected from another pregnancy after abortion.

Using the same data, S.-H. Han made the following additional observations (1973:31-47):

> The distribution of women with abortion experience is much wider compared to contraceptive users. In other words, the proportion of abortion users is relatively high both in young and late reproductive ages.

Contraception is usually started after the second birth, but induced abortion frequently occurs at the first or second parity of pregnancy.

Selectivity in abortion utilization in terms of the socioeconomic background, particularly the level of educational attainment of women, occupation of the husband, and number of modern objects owned, is far greater than that in contraceptive use.

Although there has been no systematic effort to examine the relationship between abortion and contraceptive use based on more recent data, it is apparent from various survey reports that the above observations are largely applicable to later years.

EFFECTS OF ABORTION ON FERTILITY

Since the 1960s, postponement of marriage, induced abortion, and family planning have been the major components of fertility change in Korea. Several attempts at decomposing the fertility decline by these three components have shown that they are more or less equally important in explaining the fertility change during the 1960s (Kwon, 1980; Repetto et al., 1981: Chapter 2; Koh and Smith, 1970:37, 56-57). It has also been observed that, in the early 1960s, the decline of fertility due to abortion was much more salient than that due to adoption of family planning methods, though this pattern was reversed in the 1970s. According to an estimate by Han (1973:69-71), the proportion of fertility curbed by induced abortion was equivalent to 3 percent of actual total fertility in 1960, 14 percent in 1965, and 18 percent in 1970; the most pronounced effect of abortion according to Han's estimates was almost 50 percent of actual total fertility in Seoul in 1965.

Estimation of the effect of abortion depends primarily on the method used to calculate the number of births averted per induced abortion. The above estimation, using the renewal process model of Keyfitz (1971), discloses that one induced abortion has the effect of averting 0.52 births. However, other studies show a considerably smaller effect: based on the same 1971 survey data, Hong and Watson (1972) roughly estimated that one abortion is equivalent to averting approximately

0.35 births, while Choe (1980) calculated the corresponding figure at 0.40 using 1974 KNFS data on pregnancy intervals and a life table method. It is also highly probable that the impact of abortion on the fertility levels (as measured by the number of births averted per induced abortion) has changed significantly during the last two decades with profound changes in reproductive behavior, lactation practices, and fecundity levels; however, there is apparently no information available that would permit an assessment of such changes.

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COMMITTEE ON
POPULATION AND DEMOGRAPHY

Report No. 20

Fertility Decline in Indonesia

Analysis and Interpretation

Geoffrey McNicoll
Masri Singarimbun

Panel on Fertility Determinants
Committee on Population and Demography
Commission on Behavioral and Social Sciences and Education
National Research Council

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PREFACE

Fertility and its determinants have been urgent topics for research in recent decades with the rapid expansion in world population. Attempts to control population growth have focused on reducing fertility, with some apparent effect. The peak rate of growth in the world's population has now been passed, but growth is still at a high level in almost all the developing countries. In absolute numbers, the increase in the world's population continues to rise; according to United Nations medium projections, more people will be added each year for the next 50 years than were added in 1980.

This report is one of a series of country studies of fertility determinants carried out by the Panel on Fertility Determinants of the Committee on Population and Demography. The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, about the existence and extent of recent changes in fertility, and about the factors determining reductions in fertility.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowl-

edge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the committee was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks. This work is detailed in a series of country and methodological reports from the National Academy Press, and the demographic estimation methodology developed for the country studies is laid out in a volume issued by the United Nations. As of early 1982, 168 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee initiated work on the third task in October 1979 when the separately funded Panel on Fertility Determinants was established. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive

accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the Panel on Fertility Determinants includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel. The work program of the panel includes the preparation of a report that attempts to summarize and integrate scientific knowledge about the determinants of fertility. In addition, the panel has prepared a few illustrative cross-national analyses and studies of several developing countries.

This report is the third panel country study. It has been prepared by Geoffrey McNicoll, Senior Associate and Deputy Director, Center for Policy Studies, The Population Council, New York and Masri Singarimbun, Director, Population Studies Center, Gadjah Mada University, Yogyakarta. Although it is self-contained, the study is in a sense a companion to the report of the committee's Indonesia Panel, Recent Trends in Fertility and Mortality in Indonesia (forthcoming), which critically reviews some of the demographic estimates that form the explicanda for the present document. Both the present authors were members of the Indonesia Panel. However, this study has been able to draw more widely on the results of the 1980 Indonesian census than did the panel report.

The work on this study was carried out at the Population Council and at the Population Studies Center, Gadjah Mada University. During its preparation, Geoffrey McNicoll spent two periods in Indonesia, and Masri Singarimbun visited New York to work on the manuscript. The Population Council provided computer services and the logistical support, and, more importantly, both institutions essentially supported the authors during the time they devoted to the preparation of this report. The panel and the committee are grateful to these institutions for all of this support.

The authors, panel, and committee gratefully acknowledge the assistance of several individuals who provided information, data, ideas, and helpful comments: John Bongaarts, Mead Cain, Sofian Effendi, Ken Hill, Terence H. Hull, Samuel S. Lieberman, Si Gde Made Mamas, Chris Manning, Riningsih Saladi, Richard Sturgis, Sam Suharto, and Lukman Sutrisno. An early version of the draft report was discussed at a country studies workshop organized by the panel in January, 1982, with financial assistance

from the Rockefeller Foundation. Finally, panel and committee reviewers provided advice and suggestions.

Several members of the panel and committee staff assisted in the preparation of this report. On the production side appreciation is expressed to Kate Venet at the Population Council for expert and tireless word-processing of successive drafts of the manuscript, to Irene Martinez, who helped type the text and tables, and to Rona Briere, who edited the report. Elaine McGarraugh handled the production editing details with her usual precision, alacrity, and cheerfulness.

W. PARKER MAULDIN, Chair
Panel on Fertility Determinants

SUMMARY

Indonesia's fertility has declined significantly since the late 1960s. Total fertility (the number of children born to a woman over her reproductive life under prevailing fertility patterns) was around 5.5 in the period 1967-70 and little different a decade before; early estimates from the 1980 census put it at 4.7 for 1976-79. This study sets out the complexity of the circumstances in which the fertility decline took place, assembles the available information on its pattern and proximate determinants, and seeks to identify the underlying factors responsible.

The background to the demographic change was the establishment of a new political order in 1966-67 following years of increasing conflict. The new political conditions profoundly altered the national policy environment--economic development being now accorded a central status--and altered to the realities of local administration. The local government apparatus that many observers had seen as conspicuously weak and ineffective was transformed into a strong and, in some domains, single-minded instrument of central policy. Following hard upon the successful economic stabilization measures introduced in 1967 was an export recovery, a renewed inflow of foreign aid, and a few years later, the OPEC oil price surge. Revenues poured into the government's hands and Indonesia embarked on its first period of rapid economic growth since the postwar recovery of the early 1950s. While direct benefits were unevenly spread, by the end of the 1970s some improvement in real incomes was apparent among a large section of the population. The political reorientation and economic gains together opened Indonesian society to a profusion of imported consumer goods and to more intense exposure to "western" cultural influences on consumption

patterns and styles of living. In population, the government made a strong top-level commitment to a policy goal of lower fertility. This was translated into a vigorous family planning program which rapidly blanketed Java and Bali, and later the rest of the country, with a distribution network for modern contraceptives and campaigns to promote their use.

In addition to these post-1967 changes, there was also a continuation of earlier trends of improving literacy and average educational attainment, declining (though still high) child mortality, and fewer women marrying at very young ages. The simple turnover of population was bringing the large 1950s birth cohorts into labor force and reproductive ages.

The broad picture of the resulting fertility decline can be summarized as follows. Total fertility most likely dropped by nearly one child per woman between the late 1960s and the end of the 1970s. The decline was spread throughout the country, except for the eastern provinces, but was most pronounced in Java and Sumatra. Its proximate determinants were chiefly a rapid increase in use of modern contraception in Java and, late in the 1970s, increasing use in other regions as well. In 1980 the contraceptive prevalence rate among currently married women aged 15-49 was 27 percent. By itself, the adoption of modern contraception would have cut Indonesia's total fertility by perhaps 1.5-2. The effect was partly offset, however, by falling durations of postpartum infecundability associated with shorter breastfeeding and eroding postpartum taboos which, ceteris paribus, could have raised total fertility by 0.5 or more. The increase in female age at marriage had relatively small influence on mother's age at first birth, and its effect on overall proportions of women married was largely counterbalanced by falling rates of divorce and widowhood.

The underlying socioeconomic and cultural factors that appear to have been bringing about the fertility decline can be loosely classified into those shifting the balance of economic benefits and costs of children and fertility regulation, those affecting social and administrative pressures bearing on fertility-related behavior, and those that alter people's internalized values concerning marriage, fertility, and family. Recent studies of the economics of children, mainly in Java, point to a rising child cost burden on families, especially related to needed educational expenses and to new consumption options. It is likely too that the economic implications

of family size decisions have become more salient to parents in the years since 1967, with the establishment of comparative economic stability and political calm. Modern contraception (principally the pill and IUD) has become widely available through a village-based public distribution network and is virtually free. The family planning program has been significantly assisted in meeting ambitious performance targets by drawing on local government administrative resources, resulting in untypically high contraceptive use-rates at the lower end of the socioeconomic scale.

The influence of cultural change on fertility in Indonesia is for the most part undocumented, but changes likely to have contributed to the decline include the continuing expansion of education and the spread of consumer values. Preferences remain for fairly high fertility, however. Evidence from the mid-1970s shows family size preferences centered around 4-5 children, although the actual distribution of family size (and of children ever born) shows a substantial fraction of families with 3 children or below. The publicity activities of the family planning program have rapidly changed a situation of widespread ignorance of modern contraception into one of general familiarity.

While fertility would most likely have declined anyway in Indonesia in response to the post-1967 changes in economy and administration without the strong public-sector antinatalist program, there can be little doubt that the government's efforts have speeded the process, especially as it has affected the rural poor. On the other hand, earlier in the 1960s, even had the then government shown an interest in limiting population growth, the combination of high mortality, intense politicization of local issues, and an economy sliding into hyperinflation could hardly have provided a less favorable environment for fertility reduction. Either coherent local administration or a steady economic course could have paved the way for the demographic change; both in fact came with the New Order government.

CHAPTER 1

INTRODUCTION: DEMOGRAPHIC OVERVIEW

Fertility in Indonesia has been falling significantly, although by regional standards not spectacularly, over the past 15 years. This is the consensus among demographic analysts and is the conclusion of the National Academy of Sciences (NAS) Indonesia Panel; it is confirmed by early fertility estimates from the 1980 population census. The crude birth rate, between 40 and 45 per 1,000 in the early 1960s, may now be as low as 35. Total fertility (roughly, the number of children born to a woman over her reproductive life at the prevailing age-specific fertility rates) is estimated to have declined as follows:

1967-70	5.5
1970-75	5.1
1976-79	4.7

Taking the four-year averages for 1967-70 and 1976-79 as end points, the decline is around 15 percent over the full period; less securely based single-year estimates for 1978 and 1979 from the 1980 census show a continuation and possible steepening of this decline. The Indonesia Panel, with less reliance on the 1980 census, finds a regular downward trend in fertility from the late 1960s of about 1 percent a year. The purpose of the present study is to explore the reasons for this trend.

Interest in the course of Indonesia's fertility extends far beyond the country's borders. This is partly a consequence of sheer demographic weight: with more than 150 million people, Indonesia is the third largest developing country. Java's particular situation has long fascinated demographers, and the apparently inexorable rise in population on this small island has been a cause of growing alarm. While its growth rates remain quite high, the

fertility decline is now transforming Java's demographic outlook. Another source of interest in the Indonesian experience lies in the continuing debate over the conditions of fertility decline and the extent to which family planning program activities influence fertility. Interpretations of the Indonesian case (together with those of a relatively few other countries--Thailand, Colombia, and Brazil, for example) have become central to this debate.

Indonesia was a relative latecomer to government involvement in family planning. Once started, however, the Indonesian family planning program was pursued with great vigor and effectiveness; lessons drawn from its design and administration have been applied in many other countries. However, the period of program growth (post-1967) also coincided with the establishment of a new political order following a decade of increasing conflict and, in the end, massive bloodshed. This political change brought with it comparative economic stability. It also brought, in part fortuitously, an enormous infusion of easily won government revenues that financed a surge of economic growth and the rapid expansion of schools, health programs, and numerous other government activities. As a result, expectations and, for many, everyday realities were transformed.

The combination of a new politico-administrative framework, programmatic action in family planning and on a number of other fronts, and pervasive social and economic change offers rich ground for the emergence of conflicting explanations for Indonesia's observed fertility trends. At the extremes, these explanations are simplistic, focusing on "single" factors--education, family planning program performance--that, while surely important, are only part of the socioeconomic and sociocultural matrix within which decisions that affect fertility are made. More subtlety is of course to be sought, both by adding other components of this matrix and by unbundling program packages like family planning. Unfortunately, subtlety is gained at the cost of a less sharp delineation of alternative hypotheses. Even if we had a much better empirical grasp of the case than we have in Indonesia, the nature of the analytical problem itself would still make the task one of devising persuasive explanations rather than reaching conclusive findings.

This introductory chapter sketches the main features of Indonesia's demography and then outlines the strategy of the analysis to follow.

OVERVIEW OF DEMOGRAPHIC PATTERNS

In population size, Indonesia dominates the Southeast Asian region. While it is not so large that comparisons with its smaller neighbors cease to be meaningful (as, it might be argued, is the case with India or China), regional variations in demography within Indonesia are often greater than those between Indonesia and other countries of the area. Indonesia-wide averages convey less information than do averages for countries more homogeneous in environment, society, and economy.

With this caveat, it nonetheless seems that Indonesia is now demographically much closer to "typical" Southeast Asian patterns than most observers would have predicted two decades ago. In the early 1960s Indonesia stood out in the region by reason of its high mortality and its apparently slim prospects for fertility reduction. By 1980 its death rate had fallen by one-third (although remaining somewhat above regional averages) and its birth rate probably by one-fifth. (Crude birth and death rates for 1976-79 derived from the 1980 census are 36 and 14 per 1,000 [Central Bureau of Statistics, 1982b:14].) In fertility, comparable World Bank data indicate that Indonesia stayed clustered with the Philippines and Thailand. The extent and pace of demographic transition in countries of insular and peninsular Southeast Asia over the last two decades, as recorded in these estimates, are compared in Figure 1 (World Bank, 1980, 1982b). (The broken 45° diagonal lines in the figure represent growth rate isoquants.)

It may be noted in passing that the trend line shown for Indonesia in Figure 1 is very similar to that for India over the same period (see Jain and Adlakha, 1982). India's death rate has declined from over 20 to around 14 and its birth rate from about 43 to 35 since the early 1960s. In both countries the relatively high mortality levels kept population growth well below the 3 percent range, while steady progress in lowering mortality prevented birth rate reductions from being translated into slower population growth.

Indonesia's broad demographic features can be seen from Tables 1 and 2. The geographic regions identified (see Figure 2) are those conventionally used in Indonesian population statistics. For further simplicity, Maluku and Irian Jaya are often grouped with Nusatenggara in a residual category "Other Islands," as in Table 2. Because of its demographic weight--it has more than 60

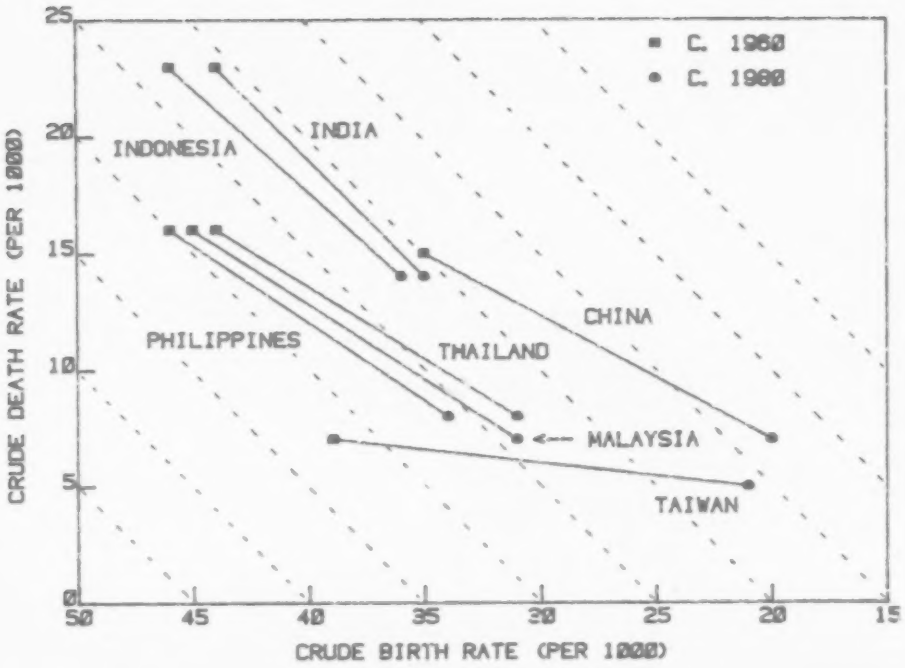

FIGURE 1 Demographic Transitions, c. 1960-80: Indonesia and Neighboring Countries

percent of the population--Java is frequently broken down into its five province-level divisions to give greater definition. If regions were selected to maximize inter-regional variation in patterns of demographic behavior in Indonesia, the major islands and island groupings used in these tables would not be the divisions chosen. Consideration of differences in rural ecology, culture and social organization, and economic conditions would lead to modification of this simple geographic picture. These complications, however, are left for later chapters in this study.

Java's population size and the extreme density contrast between Java (and Bali, with a density not far below it) and the rest of Indonesia are the dominant realities of Indonesia's demography. Natural increase in Java is appreciably less than that in the other main regions. Migration out of Java, principally to Sumatra, yields regional growth rates slightly more disparate than rates of natural increase.

TABLE 1 Population, Average Annual Growth Rate, and Population Density, by Region, 1961-80: Indonesia

Region	Population (millions)			Growth Rate (percent)		Density (persons/km^2)
	1961	1971	1980	1961-71	1971-80	1980
Java	63.0	76.1	91.3	1.9	2.0	690
Sumatra	15.7	20.8	28.8	2.8	3.3	59
Kalimantan	4.1	5.2	6.7	2.3	3.0	12
Sulawesi	7.1	8.5	10.4	1.9	2.2	55
Nusatenggara[a]	5.6	6.6	8.5	1.8	2.0	96
Maluku	0.8	1.1	1.4	2.5	2.9	19
Irian Jaya[b]	u	0.9	1.2	u	2.7	3
All Indonesia[a]	97.0	119.2	147.5	2.1	2.3	77

Note: u = unavailable.

[a]1980 total includes East Timor (enumerated population 555,000), annexed in 1976; 1971-80 growth rate excludes East Timor.

[b]Not enumerated in 1961 (Indonesia total for 1961 includes guess of 700,000 for Irian Jaya).

Source: Census data (Central Bureau of Statistics, 1981a, 1981b).

TABLE 2 Crude Birth, Death, and Natural Increase Rates by Region, 1960s and 1970s: Indonesia

Region	Annual Average 1961-70			Annual Average 1971-80		
	Birth Rate (per 1,000)	Death Rate (per 1,000)	Rate of Natural Increase (percent)	Birth Rate (per 1,000)	Death Rate (per 1,000)	Rate of Natural Increase (percent)
	(1)	(2)	(3)	(4)	(5)	(6)
Java	41	21	2.0	35	15	2.0
Sumatra	47	22	2.5	40	13	2.7
Kalimantan	45	22	2.3	40	15	2.5
Sulawesi	46	23	2.3	41	15	2.6
Other Islands	44	24	2.0	45	17	2.8
Indonesia	43	22	2.1	38	15	2.3

Sources: (1) 1971 census estimates of age-specific fertility rates (Central Bureau of Statistics, 1976); adjusted mid-decade age distribution for Indonesia from Speare (n.d.); age distributions for regions taken from 1971 census with resulting birth rates adjusted to make their weighted average equal the estimate for Indonesia; (4) for Indonesia, average of age-specific fertility rates for 1971-75 and 1976-79 from Table 2, age distribution for 1976 from SUPAS II (Central Bureau of Statistics, 1978a); for regions, average 1974-78 age-specific fertility rates applied to 1979 age distributions from 1979 SUSENAS, with resulting birth rates adjusted to make their weighted average equal the estimate for Indonesia; (3) and (6) for Indonesia, average intercensal growth rates; for regions, computed as residuals from birth and death rates; (2) and (5) for Indonesia, computed as residuals; for regions, death rates implied by child mortality estimates (Table 3), adjusted for consistency with Indonesia estimate.

FIGURE 2 Map of Major Regions and Provinces: Indonesia

As Table 2 indicates, both fertility and mortality declines have been widespread in Indonesia. Regions outside Java, with the apparent exception of the eastern provinces (Nusatenggara, Maluku, Irian Jaya), have shown proportionately similar reductions in birth rates and greater reductions in death rates as compared to Java. The Indonesian transition now underway is not a Java-centered phenomenon.

Establishing consistent sets of regional vital rates for Indonesia is far from straightforward, as the source note to Table 2 implies. Age distribution data are often suspect, and census underenumeration is likely to have been significant in some regions. Registration data are as yet too incomplete for estimation of vital rates. It is particularly difficult to reconcile natural increase estimated as a residual from birth and death rates, as in Table 2, with natural increase derived from intercensal growth rates (Table 1) and estimates of interregional migration (for example, those of Speare, 1979, or Hugo, 1980). The discrepancies are largest in Sulawesi and Other Islands, regions where we would guess that census coverage errors play a substantial role. In Sumatra and Kalimantan, it is plausible that the scale of inmigration has been greater than assumed.

Fertility, being the main subject of this study, need not be discussed further in this overview; an additional word on mortality is called for, however. The main sources of mortality information in Indonesia are child mortality estimates from retrospective child survival data. These are the basis for the regional death rate differentials in Table 2. The regional pattern of child mortality and the strong decline Indonesia has experienced in this area since the late 1960s are shown in Table 3. (Fragmentary information from the 1961 census suggests that the decline in fact began in the 1950s.) If it can be assumed that Indonesia's age pattern of mortality at young ages follows the United Nation's "South Asian" model schedule (United Nations, 1982), the child mortality estimates for Indonesia shown in the table correspond to an infant mortality rate of 135 deaths per 1,000 births in 1967-69 and 100 in 1975-76. The NAS Indonesia Panel's conclusions, based on a more eclectic array of data, are similar: infant mortality rates of 130 per 1,000 in the early to mid-1960s and 105 ten years later.

Much less is known about adult mortality in Indonesia. In work undertaken for the Indonesia Panel, it was concluded that mortality was relatively low at ages 10-45

TABLE 3 Child Mortality Implied by 1971 and 1980 Census Retrospective Data on Child Survivorship, by Region: Indonesia

Region	q(2) 1969	q(2) 1976	q(2) Percent Decline	q(3) 1967	q(3) 1975	q(3) Percent Decline
Java	.176	.127	28	.191	.140	27
Sumatra	.179	.116	35	.194	.115	41
Kalimantan	.179	.127	29	.196	.144	27
Sulawesi	.187	.130	30	.205	.122	40
Other Islands	.207	.162	22	.224	.177	21
Indonesia	.179	.130	27	.194	.137	29

Note: q(x) is probability of death before exact age x.

Sources: 1967 and 1969 estimates (based on 1971 census data), Indonesia Panel (1982); 1975 and 1976 estimates computed from 1980 census data in Central Bureau of Statistics (1982a) using West model Brass-Sullivan regression coefficients.

and relatively high above 45 compared to standard model structures--a pattern characterized as "modern medicine-high poverty." Life tables were prepared for Indonesia for 1964 (females) and the mid-1970s (both sexes) by splicing together independent estimates of child and adult mortality; these show infant mortality rates of 159 and 105 per 1,000 births and life expectancies of 46 and 50 years (see McDonald, 1978; Indonesia Panel, 1982).

OUTLINE OF THIS STUDY

The objective of this study is to account for the onset and course of fertility decline in Indonesia--its timing and its pattern (both geographic and socioeconomic). In linking demographic outcomes to their social and economic context, it attempts to draw a detailed picture of the intermediate fertility variables--the so-called proximate determinants. As will become clear in Chapter 3, our knowledge of the proximate determinants of Indonesian fertility is as yet quite incomplete except for age at marriage and contraceptive use, although later analysis of the 1980 census will fill some of these gaps.

Chapter 2 sketches the background of contemporary demographic change in Indonesia: a murky picture of nineteenth- and early twentieth-century population growth, interrupted during the turbulent close of the colonial period, and coming for the first time into sharp focus in the 1960s; and a complex pattern of economic and administrative change pivoted on the decisive transformation of Indonesia's political order in the mid-1960s. Although necessarily highly abbreviated, the latter account should suggest the scope of Indonesia's socioeconomic development in the post-1967 period.

Chapter 3 presents detailed information on total fertility in Indonesia from the last two censuses and the 1976 and 1979 national surveys and assembles the scattered materials that say something about its proximate determinants. The accounting scheme devised by Bongaarts (1978, 1982), linking total fertility to indices of marriage, breastfeeding, contraception, and abortion, is used in part as a consistency check and in part as a means of inferring from incomplete data the magnitudes of particular proximate factors. Even for Java, few of these indices can be estimated with much assurance. In the rest of Indonesia, the data base is still less complete, and supporting assumptions as a result have had to be more heroic. Throughout Indonesia, estimates of time trends in proximate fertility determinants--a potent source of insight for analyzing fertility change--are not securely founded and need to be used with caution.

The system comprising the fertility outcome and its proximate determinants has lost any of the neatness as a dependent variable that is possessed, say, by a simple index of total fertility. The advantage gained is a highly valuable refining of the explicandum: we know much more about what has to be explained, and, just as important, what does not have to be explained. The danger to be avoided is that of trying to explain each of the proximate determinants separately while forgetting their interdependencies. Marriage, defensibly, has a set of socioeconomic and cultural determinants to some degree separate from that of fertility patterns within marriage; even here, however, and a fortiori for the proximate determinants of marital fertility, the possibility should be admitted that family-size considerations may be the dominant decision-making force.

Given this complexity of the dependent variable, there is little analytical gain to be expected from standard multivariate analysis. A more eclectic approach is

required to reach an understanding of shifting fertility patterns--one that can examine the same phenomenon from a variety of angles. Chapter 4 is an attempt at such an approach, drawing on and, where needed, supplementing the empirical materials of Chapter 2.

The final chapter draws together the preceding account and tries to elicit its implications for future Indonesian fertility trends. Although the purpose of the present study is essentially analytical--seeking to understand what has happened in the recent past--one of its obvious motivations is to glean policy lessons for the future. These are discussed briefly in the concluding pages of the chapter.

CHAPTER 2

CONTEXT OF DEMOGRAPHIC CHANGE

Current demographic change in any society is both a consequence of behavioral patterns formed over past generations and a response to contemporary shifts in socioeconomic and cultural circumstances. Ideally, therefore, an understanding of Indonesia's modern fertility decline would be based on a sound knowledge of the factors contributing to the country's earlier population growth, and on careful documentation of relevant aspects of the economic, social, and cultural environment of current demographic behavior. For both, and especially for the historical dimension, only a rough sketch is possible here.

HISTORICAL POPULATION GROWTH

Indonesia's recorded demographic history, at the national level, gains a secure footing only with the 1930 census. Prior enumerations, chiefly those of 1905 and 1920, give possibly adequate population totals for Java, but are highly questionable elsewhere (see Widjojo, 1970). Even the 1930 census, while rich in ethnic detail, is virtually devoid of the age distribution data that are essential for most of modern demographic analysis. After 1930 there is a long gap in the record, spanning the Japanese occupation (1942-45) and the war of independence (1945-49), until the first modern census in 1961. Only in the 1970s did enough census and survey data become available to allow demographic estimates to be checked for consistency. (See the Appendix for a discussion of Indonesian data sources.) Hence it is a tenuous undertaking to reconstruct aggregate population growth for Indonesia prior to the most recent decades, let alone to infer the constitu-

ent rates of fertility and mortality. (Research focusing on local demographic patterns, however, offers somewhat more promise.)

Java's population, it is widely believed, experienced at least a three-fold, and possibly a four- or five-fold, increase over the nineteenth century (from below 10 to near 30 million). The implied average rate of increase, some 1.3-1.6 percent annually, is somewhat higher than India's in the same period. As there, this increase was variously viewed with colonial pride in the administrative and infrastructural developments whose efficacy it supposedly proved, or belated alarm at the absence of concomitant improvements in individual welfare. A further doubling of the population took place in the twentieth century up to the 1961 census. Outside Java, the growth rate is essentially unknown until well into this century. Table 4 sets out what we would consider the best-supported historical estimates of population

TABLE 4 Population Size and Growth Rate in the Nineteenth and Twentieth Centuries: Indonesia

Year	Java	Other Regions	All Indonesia
Population Size (millions)			
1815	6-10	u	u
1850	12-13	u	u
1905	30.1	u	u
1930	41.7	19.0	60.7
1961	63.0	34.1	97.1
1980	91.3	56.2	147.5
Annual Growth Rate (percent per year)			
1815-1850	0.7-1.4	u	u
1850-1905	1.5	u	u
1905-1930	1.3	u	u
1930-1961	1.3	1.9	1.5
1961-1980	2.0	2.6	2.2

Note: u = unavailable or gross underenumeration.

Sources: 1815, 1850: Breman (1963), Peper (1970); 1905-1980: census totals (Widjojo, 1970; Central Bureau of Statistics, 1981b).

size and growth rates, together with recent census totals. (See Widjojo [1970] for a thorough evaluation of Dutch colonial demographic statistics, and Breman [1963] and Peper [1970] for proposed new population trajectories for nineteenth-century Java.)

Theories of Population Growth in Java

The explanation of Java's sustained population growth in colonial times is of more than historical interest. It could potentially throw much light on the current fertility decline--in particular, on the issue of whether this decline is better seen as a transition from a "natural" to a "controlled" fertility regime or as an adaptation to cultural and socioeconomic change. Consider the following three alternative explanatory hypotheses.

- A straightforward Malthusian position would be that Java's fertility until the last 15 years or so was, in the technical sense of the term, "natural"--that is, that the factors holding the birth rate below its biological upper limit were not connected to any deliberate parental effort to regulate family size. A fortiori, the same position would also see infant and child mortality as natural. (Lengthy breastfeeding practiced for the child's or mother's health is consistent with natural fertility; so, too, would be adherence to a cultural tradition of long postpartum or terminal sexual abstinence not consciously tied to individual demographic interests.) Java's population growth could then be explained by a minimal colonial government role in reducing catastrophic peaks in mortality through such measures as improved transport, expansion of irrigation, quarantine, and so on. Such changes would have allowed the population to increase under a more or less constant force of fertility with fewer recurrent setbacks. This roughly parallels the "Princeton" view of preindustrial Europe (Coale, 1975), and resembles the conclusion reached by Knodel and Debavalya (1978) on pretransition Thailand. It is the case assumed by many writers (for example, van de Walle, 1973) for Java. Accommodation of sustained population growth in turn drives and directs technological change, favoring in particular the process of labor intensification in agriculture, and compels increasing reliance on very low-productivity rural activities.

• The classical economic argument that fertility responds to changes in the demand for labor offers a different kind of explanation. The Dutch built up a large estate sector in Java, producing export crops such as sugar, coffee, and indigo. To support this sector, a substantial amount of both labor and land were in effect withdrawn from the peasant economy--involuntarily for the families concerned and with meager wage compensation of labor services. This situation may have elicited a demographic response--either higher fertility or lower child mortality--as families struggled to survive on a truncated resource base by substituting new labor for land. A more benign variant of this argument might see the demographic response more positively, as the result of families trying to take advantage of the new labor opportunities created by the export sector. The former case is set out by White (1973), who speculates that the adjustment mechanism may have been a conscious or unconscious reallocation of food from parents to children as child survival became more important to family welfare. Alexander and Alexander (1979) adduce some supporting evidence for a labor-supply response by families, drawn from their study of Pasuruan, a major East Java sugar cultivation region, in the nineteenth century. A less specific labor-demand case for colonial population growth in Java is made in Keyfitz (1965).

• Neither of the previous hypotheses pays much attention to the dimension of social organization beyond the family. Yet the Javanese village played an important intermediary role in relations between the estate and peasant economies. In the sugar areas particularly (Java prior to the Great Depression was one of the world's major sugar producers), the centrals negotiated land rental agreements with village leaders rather than with individual landholders. The effect was to create (some have argued, preserve) a system of communal landownership under which at regular intervals, usually each year, families in the village would be allotted portions of the land not under cane at the time, to some degree according to their need. This perpetual reallocation of land, perhaps together with other communal customs that existed widely throughout Java, served to level intravillage differences and plausibly to diminish economic incentives to limit family size. Families, in effect, were precluded from operating as economically autonomous peasant proprietors--for whom control over reproduction would be an important

welfare instrument. This argument is at least implicit in Kolff (1929), C. Geertz (1963), and Aass (1980).

If the first of these hypotheses was in fact the case, the recent widespread adoption of modern contraception has been a radical cultural innovation--a sudden spreading of the realization that fertility is indeed controllable and that family-size limitation is in one's own interests. The puzzle to be solved would still be large, but fairly circumscribed. If the second hypothesis was borne out, families can be assumed to have always acted in their best interests, with demographic choices included among those that were open to them. Family-size limitation may have been seen as too costly, or may have been avoided because mortality risks were too high, but under the circumstances a roughly optimal welfare strategy would have been followed. As price relativities altered over time, appropriate adjustments in behavior, fertility included, would have been made. In particular, fertility declines would have followed a fall in expected child mortality, a lower cost of fertility regulation, and a higher net burden of childraising.

The third hypothesis does not intrinsically deny that families could act purposefully in their own demographic interests, but suggests that the specific institutional arrangements they confronted may have eroded the value of such actions and would often have favored alternative kinds of response. More generally, the hypothesis stresses the role of societal institutions other than the family and colonial estates in governing fertility. The picture is thus considerably more variegated than one in which an imposed labor demand elicits a fertility increase. The social arrangements within which individuals and families operate are seen as having their own continuities and their own kinds and time-scale of response to changing technological and political conditions. These arrangements set many of the constraints, cultural as well as economic, within which individual demographic behavior must be worked out. Detailing how and why they shift over time becomes an important part of the explanation for fertility change.

Not surprisingly, the sketchy evidence on historical Java so far assembled--both statistical data on the rural economy and population and qualitative studies of rural institutions--does not go far toward settling these fundamental differences in interpretation. (The differences are not without political significance: pure labor-demand

explanations accord better with a class analysis of Javanese society; institutional explanations with a picture in which class divisions are muted or overlain by other groupings.) The evidence does, however, seem to support the feasibility of consciously adaptive fertility responses in historical Java and suggests that these played some part in the resulting pattern of population growth.

The practice of postpartum and terminal abstinence has probably been widespread in central and eastern Java for many generations, according, as it does, with Javanese cultural values of asceticism and self-control. Under then-prevailing mortality, only three out of five children born would be expected to reach adulthood. Demographically, abstinence would have had the effect of prolonging breastfeeding (preventing it from being interrupted by pregnancy) and thus enhancing child survival chances. Although culturally rooted, this behavior would have permitted "fine-tuning" of fertility--long before the advent of modern contraception--in response to changes in individual circumstances. Given its presence, it is difficult to think of Java's pretransition fertility as wholly "natural."

No firm conclusions can be drawn on the degree to which such fertility adjustments were in fact made, given the structure of the economic incentives and the high child mortality risks. The matter is still, however, an active research question. In Chapters 3 and 4 we encounter the same set of issues, although with better documentation, in attempting to account for Indonesian demographic change in the recent past.

Depression, Occupation, Revolution, 1932-49

The 1930s and 1940s witnessed major disruptions in Indonesian society and economy as the colonial era came to an end in economic depression and war. These events had demographic repercussions, the magnitude of which can be read, if only imperfectly, in later age distributions. First-generaion echo effects of the small surviving cohorts from this period would have contributed to a birth rate decline in the 1960s.

Three approaches can be used to shed light on vital rates in Indonesia over these years. First, the events themselves can be examined for their likely demographic impact, both in qualitative terms and by drawing on the fragmentary statistical records of the time. Second, the

prewar (1930) census can be linked to postwar enumerations by a projection under fertility and mortality assumptions designed to minimize discrepancies in size and age structure between the projected and enumerated populations. Third, the postwar census data, corrected as far as possible for age misstatement errors, can be projected backward to recreate successive past birth cohorts.

The first of these approaches provides the a priori expectation that net reproduction was low throughout much of the 1930s and 1940s, especially the early 1940s. The Great Depression hurt the Indonesian economy badly, causing the collapse of its major agricultural export industries. Export revenues in 1933 were less than one-third of their level in 1928, and subsequent recovery was slow and partial. Then in 1942 came the Japanese occupation with its wide use of forced labor and harsh food procurement policies. Scattered registration data on Java show death rates of 30-40 per 1,000 in some areas in 1944 (see Indonesia Panel, 1982). Finally, there were 4 years of struggle against the returning Dutch forces to confirm the 1945 declaration of national independence; though not uniformly intense, this resulted in considerable destruction of fixed capital.

It is reasonable to assume that Indonesia's population in 1930 was stable. (For strong supporting evidence of stability see Feeney, 1979b.) On this basis, and with estimated birth and death rates for the time, the census total is supplied with an age structure. Then, using a procedure somewhat like that suggested by Keyfitz and Murphy (1965), a time-series of age-specific birth and death rates can be constructed that projects this population forward to 1961 and subsequent census years, in reasonable agreement with the enumerated population sizes and age structures. The result should be a consistent, although not unique, fertility and mortality time series. (Poor-quality age distribution data in the early postwar enumerations leave plenty of room for differing judgments, however.) One such series was developed for Java by Widjojo (1970)--initially without a postwar age distribution to test against, but subsequently supported by the 1961 census. Another, for Indonesia as a whole and using the 1971 census and the 1976 Intercensal Population Survey (SUPAS I), was prepared by Speare (n.d.). Both show a fertility drop and mortality rise occurring in the 1940s: for Widjojo (Java), the birth rate fell 13 percent and the death rate rose 16 percent compared to 1935-40; for Speare (Indonesia), the corresponding changes were 9 percent and 15 percent.

These trajectories were initially selected to conform to preconceptions about 1930-61 demographic trends. A less biased starting point would be the postwar age distributions themselves. An innovative procedure for correcting age-heaping, developed by Feeney (1979a), allows these distributions to be cleaned and hence to become usable as a basis for inferring past levels of fertility and mortality. The method in concept is very simple: the ratio of population in a given age group, say 35-39, in two postwar enumerations five years apart, say 1971 and 1976, can be taken as an estimate (under obvious mortality and migration assumptions) of the ratio of births in the two successive periods in the past--in this case, the two five-year periods following 1931. Applying this method in its analysis of age distribution errors, the Indonesia Panel (1982) concluded that there was declining fertility (or rather, fertility net of infant and child mortality) at a slowly increasing rate during 1932-37, 1938-41 and 1942-47, with a low point reached during the last period. After 1947, and again in some indeterminate combination, fertility evidently rose and infant and child mortality fell, until the ratio of births in successive five-year periods nearly reached the value it had maintained prior to 1932.

Further confirmation of this sequence can be read from the cumulative fertility estimates by age of woman in the postwar censuses. East Java, the only extensive province for which the 1961 census results were tabulated, can be used for illustration. The reported average number of children born to ever-married women aged 35-44 and 45-54 in East Java in three successive ten-year birth cohorts (drawing on 1961, 1971, and 1980 census data) is as follows:

Birth Cohort	35-44	45-54
1906-16		4.25
1916-26	3.91	3.79
1928-36	3.99	4.48

(The empty cell results from the absence of any source of data for around 1950.) The 1916-26 birth cohort experienced its peak reproductive years in the 1940s. The fertility of the cohorts before and after it would have been much less influenced by events in that decade. The last column clearly shows the dip in completed fertility; the 35-44 column confirms the upswing.

Independence and After, 1950-67

The record of demographic trends in the 1950s has little better empirical grounding than estimates made for the previous two decades. Birth and death rates seem to have returned to their prewar levels, with fertility constant (aside from a possible surge of deferred births early in the decade) and mortality resuming a slow decline. Table 5, analogous to the one above but for all Indonesia (and taking five-year age groups and birth cohorts), shows the fertility recovery: average completed parity increases from 4.90 for the 1920-25 birth cohort to 5.52 for the 1930-45 cohort--the latter having its childbearing years in the 1950s and 1960s.

Maternity histories gathered in the 1973 Fertility-Mortality Survey and the 1976 Indonesia Fertility Survey (SUPAS III) both suggest fairly constant fertility levels through the 1960s. The latter survey, for example, estimates a uniform total fertility rate in Java and Bali of 5.5 from 1962 to 1968 (Indonesia Fertility Survey, 1978: Table 6.10). The 1973 survey suggests a slight increase in total fertility in Java through the 1960s but constancy in Sumatra and Sulawesi (McDonald et al., 1976:Table 3.4). The crude birth rate probably began to decline in the 1960s as the small 1940s birth cohorts entered child-

TABLE 5 Average Parity of Ever-Married Women by Age and Birth Cohort: Indonesia

	Age Group				
Birth Cohort	25-29	30-34	35-39	40-44	45-49
1920-25					4.90
1925-30				4.98	5.32
1930-35			4.90	5.33	5.52
1935-40		4.21	5.10	5.38	
1940-45	3.10	4.18	5.01		
1945-50	2.91	3.98			
1950-55	2.76				

Sources: Upper diagonal (1971 census data), Cho et al. (1980: Appendix Table 1) adjusted by proportions ever married; middle diagonal (1976 SUPAS II data), Central Bureau of Statistics (1979a:Table 1.8); lower diagonal (1980 census data), Central Bureau of Statistics (1982a:Table 20).

bearing ages; the average rate for the 1960s of 43, given in Table 2, may well have been several points higher at the beginning of the decade.

Retrospective child mortality estimates from the 1961 and 1971 censuses for the three provinces (all in Java) where the former data exist show declines over 10 years from the early 1950s of around 25-35 percent (McNicoll and Mamas, 1973:43)--a trend that, as noted earlier (Table 3), has continued at about the same pace in the 1970s. It is likely that the rest of Indonesia experienced a similar fall in child mortality in the 1950s. Food supplies and distribution recovered from their wartime dislocations; the economy was reaping the benefits of the Korean War boom in export prices; and new public health measures, such as a malaria control program, were being put into effect. Compared to that of other countries in the region, Indonesia's mortality was still high well into the 1960s. The average death rate for Indonesia in the 1960s was estimated earlier to be 22 per 1,000 (Table 2). In the only Indonesian life table for that period that has been constructed using both child and adult mortality information (for around 1964), female life expectancy is estimated to be 46 years (McDonald, 1978). (It may be noted that the killings that followed the 1965 coup attempt, numbering possibly in the hundreds of thousands, would have had a barely perceptible impact on the overall death rate in Indonesia: if a normal year in the 1960s showed a crude death rate of 22, in 1965 and 1966 the rate may have risen to 23 or 24.)

SOCIAL CHANGE AND DEVELOPMENT SINCE 1967

A decisive turning point in Indonesia's history as an independent nation came in 1966-67 with the transfer of power from President Sukarno to President Suharto and the establishment of what immediately became known as the New Order government. The development effort over the preceding 15 years is well capsulated by Arndt (1975:85):

> From 1950 until 1958, successive governments struggled to promote economic development in conditions of chronic inflation, balance-of-payments difficulties and increasing political instability. From 1958 until 1965, under Guided Democracy, as orderly processes of government, including the capacity to tax, gradually disin-

> tegrated and inflation turned into hyperinflation, as everchanging and multiplying regulations superimposed new direct controls on unenforceable older ones, as output of nationalized estates and industrial plants declined and smuggling further dissipated the country's dwindling foreign exchange earnings, as Sukarno's diminishing capacity to raise further foreign credits prompted him to tell the world to 'go to hell' with its foreign aid, economic activity continued despite rather than because of the government.

Deepening economic disarray and increasing political tension between Communist and Muslim parties culminated in a Communist-supported attempted coup in September 1965, followed for several months by violent reprisals against Communist Party members and sympathizers throughout the country. While the present study is primarily concerned with the post-1967 period, some of the roots of recent demographic change are to be found in these earlier years and in the traumatic period of the middle 1960s.

The following brief survey outlines the recent course of economic growth in Indonesia and the changes in social organization and local administrative arrangements that have taken place. Some of the factors likely to be bringing about sociocultural change are also noted.

Economic Growth

In the 1960s Indonesia's economic future looked bleak. Economic mismanagement was reflected in a declining volume of exports, a balance-of-payments crisis, stagnant agricultural productivity, a highly visible deterioration of capital stock, and a cost-of-living index that on a base of 100 in 1960 had passed 250,000 by the end of 1967. A prominent geographer (Fisher, 1967) argued persuasively that the nation's natural resource base, far from being a vast potential source of wealth as so much of the political rhetoric of the time averred, was in fact quite modest when set against the large population.

The turnaround in economic outlook came remarkably quickly in the late 1960s and early 1970s. Major economic changes in the New Order regime can be listed simply: the rapid achievement of comparatively stable prices after the hyperinflation of the mid-1960s; a strong recovery of export revenues, particularly deriving from petroleum and

logging, and of course expanding after 1974 with the OPEC price increases; the development of revenue-sharing programs for provincial and local government; large investments in economic infrastructure (communications, roads, irrigation); and successful promotion of "green revolution" technologies and inputs.

The drastic stabilization program of the late 1960s left the economy well placed to benefit from the strong impetus given it by the jump in oil and gas prices. As Table 6 shows, Indonesia's gross domestic product (GDP) grew during the 1970s at about the same rate as Thailand's and Malaysia's, both countries that are in the strong "second tier" (behind South Korea, Taiwan, Hong Kong, and Singapore) of the dynamic East Asian regional economy. Per capita income (admittedly a crude indicator of welfare in an oil-export economy), while still low by East Asian standards, has now moved well ahead of South Asian levels. In 1981 Indonesia graduated from being a "low-income" country to become "middle-income" in the World Bank's categorization.

Indonesia's export growth in the 1970s--6.5 percent annually in quantum terms--yielded an increase in export revenues averaging over 20 percent per year in constant dollars. Overwhelmingly, exports were and remain raw materials. In 1980, for example, out of total exports of $22 billion, manufactured exports made up less than $500 million (World Bank, 1982b). On a per capita basis, as the last column of Table 6 indicates, Indonesia's success in exporting manufactures has been minimal, even compared to China and India, and contrasts strikingly in this respect with the Philippines, Thailand, and Malaysia.

The export boom and a substantial flow of foreign assistance have financed large development budgets. Investment as a proportion of GDP increased from 8 percent in 1967 to over 20 percent a decade later. There have been important shifts in both sectoral and regional distribution of product. Agriculture's share of GDP fell from around 50 percent in 1969 to below 30 percent in 1980--a drop wholly taken up by the expansion of the mining sector (from 5 percent to over 25 percent of GDP, although at constant prices mining shows almost no change); manufacturing and utilities contributed some 10 percent of GDP in 1980, about the same as they had a decade earlier (Dick, 1982). The regions benefiting from natural resource development, principally oil and timber, are all outside Java (and also outside Nusatenggara). Balancing the evident self-interest of resource-rich

TABLE 6 Comparative Economic Development Performance, 1970-80: Indonesia and Selected Other Asian Countries

Country	GNP per Capita ($) 1980	Av. Growth Rate of GDP (percent p.a. at const. prices) 1970-80	Agricultural Sector		Av. Growth Rate of Exports (percent p.a.) 1970-80	Exports per Capita ($) 1980	Manuf. Exports per Capita ($) 1979
			Share of GDP (percent) 1980	Share of Labor Force (percent) 1980			
Indonesia	430	7.6	26	58	8.7	149	3
China	290	5.8	31	71	u	19	5
India	240	3.6	37	69	3.7	10	6
Malaysia	1,620	7.8	24	50	7.4	991	141
Pakistan	300	4.7	31	57	1.2	31	14
Philippines	690	6.3	23	46	7.0	122	33
South Korea	1,520	9.5	16	34	23.0	459	348
Thailand	670	7.2	25	76	11.8	138	28

Note: u = unavailable.

Source: World Bank (1982b). Reprinted by permission.

provinces against demands for interregional equity has been a considerable accomplishment of the New Order government; improvements in roads and interisland transport and large investments in telecommunications have also contributed much to the integration of the national economy.

For the subject of this study, we are particularly interested in how these aggregate economic changes have affected people's livelihoods, especially among families at the broad base of the income distribution. Consider the demographically dominant rural sector. Among the 80 percent of Indonesian families living in rural areas, a steadily shrinking proportion are landholders, and, on Java at least, minuscule plots are the norm. Writing of Java in the early 1970s, Sajogyo (1973:68) divided the then 12 million or so agricultural households into three categories: (1) 4 million farmers with farm sizes above 0.5 ha., accounting for 80 percent of total farmland (and a somewhat higher proportion of irrigated rice land); (2) another 4 million marginal farmers (0.1 to 0.5 ha.; "they could be called 'transitional farmers' if only one could tell what place and future [they had] to go"); and (3) 2 million near landless (below 0.1 ha.) and possibly the same number fully landless. Population growth steadily enlarges the numbers on the bottom rungs of this ladder: by 1980 fewer than 3 million households on Java farmed more than 0.5 ha. (Central Bureau of Statistics, 1981c: Table 14). Outside Java (and Bali), cultivated areas are still expanding--by 23 percent between the agricultural censuses of 1963 and 1973--under local population growth and resettlement from Java and with further extension of estate agriculture. More than half of farm households operate farms greater than 0.5 ha., although the larger area is partly offset by poorer-quality land and less developed irrigation than on Java (Central Bureau of Statistics, 1981c:Table 14; Leiserson et al., 1980:28).

The seed-fertilizer revolution in rice production (rice contributes around two-thirds of Indonesia's total food crop production expressed in calorie equivalents) firmly took hold in Indonesia during the 1970s, benefiting, as elsewhere, the larger farmers first and most. Substantial investments have been made in rehabilitating irrigation systems and in beginning to combat serious problems of erosion and deforestation. Aggregate results have been impressive: a 50 percent increase in rice output over the decade, mostly attributable to the high yields of the new rice varieties under heavy fertilizer

use and to more extensive double and triple cropping permitted by their shorter growing season and the improvements in irrigation systems (Warr, 1980).

In man-days per hectare, the high-yielding varieties absorb slightly more labor than the traditional varieties. Other, opposing changes in labor utilization that are not directly tied to the green revolution are probably more significant, however. These include substitution of sickles for hand knives in harvesting; in some regions the use of small tractors for ploughing and transporting paddy, and rotary weeders to replace hand weeding; the spreading practice by landholders of contracting out the task of harvesting instead of letting anyone participate and receive a share; and the introduction of mechanical rice hullers, which in short order have eliminated the formerly standard practice of hand pounding. These changes have reduced the numbers of people (per unit area) participating in rice production, especially women. (The subject is intensively examined in various studies of the Agro-Economic Survey--for example, Collier et al., 1974; see also Utami and Ihalauw, 1973, and Hayami and Hafid, 1979.)

For the rural population as a whole it is possible to overemphasize these changes, however. "Occupational multiplicity" has probably characterized rural workers in Java for decades, with rice cultivation one (albeit usually the most remunerative) among many income-generating activities, agricultural and nonagricultural (see White, 1976, and Hart, 1978, for illustrative data on time use in village Java). High rates of landlessness are similarly not new in Java. Trends in individual or family economic conditions cannot be read from information on a single industry, even one as large as rice. The improved agricultural productivity and the other resources flowing into the domestic economy could have had more than compensating employment and welfare effects. We must instead look at overall patterns of labor absorption, outside as well as within the farm sector, and at trends in real wages and incomes.

A recent World Bank study computes Indonesian employment growth based on census and labor force survey (SAKERNAS) data in the 1970s by sector: overall employment grew at 3.3 percent per year; agricultural employment by 2.2 percent; manufacturing and mining by 2.7 and 3.1 percent, respectively; and construction, trade, and services by 6.2 percent (Mazumdar and Lluch, 1980). The expansion of trade and services in rural areas in the

1970s was particularly notable, with these categories accounting for nearly as many people newly employed as all of agriculture. Unfortunatly, there is almost no hard information on the distribution of activities within trade and services, to permit distinguishing between those that are comparatively productive and those that have a social (and often private) product close to zero.

There is little to be learned from dividing employment growth into rural and urban. Improvements in transport have been among the most significant economic changes in recent years in Indonesia. Total motor vehicle registrations have grown by an average 13 percent per year over the 1960s and 1970s. By the late 1970s, motorcycle ownership was above 16 per 1,000, four times its level in 1970. One household in three in both rural and urban areas owned a bicycle (Central Bureau of Statistics, 1980, 1982a). What has come to be known as the "Colt revolution," named after the Mitsubishi pickup truck that is converted to serve as a minibus, has transformed rural and intercity public transport. Labor markets thus have been broadened, and some of the familiar distinctions between urban and rural areas have come to be obscured. The rapid expansion of commuting and "circular migration" by rural workers in the 1970s in Java and Bali is well documented (see particularly Hugo, 1978, 1981, and Mantra, 1981). Better transport also influences trading market areas. The narrowing of price differentials formerly sustained by transport frictions has eroded opportunities for micro-sale retailing and arbitrage just at the time when more people are seeking those opportunities.

Two kinds of information promise to permit judgment about trends in economic conditions at the family level, circumventing the intricacies of seasonality and multiple occupations that cloud Indonesia's labor force data. One is statistics on wages and consumption expenditures and on income-sensitive characteristics such as infant mortality; the other is the casual empiricism of informed observers.

On the first of these, most of the evidence points to rough constancy of real wages for unskilled labor since the late 1960s, although with substantial year-to-year fluctuations (see, for example, Makali and Hartoyo, 1978; Mazumdar and Lluch, 1980). On the other hand, per capita GDP has been rising at about 5 percent per year in real terms over this period (in the first half of the 1960s it was falling), and, more to the point, there have been substantial increases in real per capita consumption levels.

Sundrum (1979) estimates the consumption increases between 1970 and 1976 to be 44 percent in urban Java, 19 percent in rural Java, and 9 and 8 percent, respectively, in urban and rural areas outside Java. The main beneficiaries of these gains have been those employed in the more capital-intensive industries and in the modern service sector (particularly government), as well as the larger rice farmers. Whether any benefits have also been felt by those at the bottom of the income distribution has been an issue of contention, but the evidence increasingly suggests that they have. Household consumption data from the National Socioeconomic Surveys (SUSENAS) of 1969-70 and 1976, although not to be accepted uncritically, point to an improvement over that period for all income groups both in Java and in other regions (Leiserson et al., 1980:82).

Child mortality estimates by birth cohort and parents' socioeconomic characteristics have been calculated by McDonald (1980) from the 1976 Indonesia Fertility Survey (SUPAS III) of Java and Bali. The percentage of children dying before age 5 in three birth cohorts (those born before 1961, during 1961-66, and during 1966-71), classified by education of father, show declines over time in each category and a slight narrowing of the large differentials by education:

Education of Father	Before 1961	1961-66	1966-71
None	27	22	17
Primary	23	20	16
Secondary	12	11	9

While more than just economic forces are involved here, the pattern certainly suggests improving levels of welfare among those at the bottom of this ladder.

Anecdotal evidence of trends in economic well-being, not necessarily less reliable than these statistics, generally supports this picture. Critchfield's 1979 travels in Java, surveying conditions in 35 villages and comparing them with his own and his respondents' memories of the 1960s and early 1970s, is strikingly upbeat (Critchfield, 1981:178):

> There were a few pockets of deep, grinding poverty--wherever there was too much water (flood plains) or too little (dry upland plateaus or

> brackish coastal flats). With these few exceptions, Java had prospered dramatically between 1974 and 1979. When asked 'Are you richer or poorer than you were ten years ago?' every single one of a couple of hundred villagers replied that he was better off . . . . The landless poor had not been left out; daily field wages had gone up, on the average and in terms of the food they could buy, by a quarter to a half kilo of rice per day since 1970.

While somewhat Panglossian in tone and devoid of sensitivity to local-level realpolitik, Critchfield's observations cannot be dismissed as uninformed. Systematic resurveys of villages earlier subjected to intensive study, hence relying less on casual empiricism, also record significant economic growth associated with rice intensification and access to urban labor markets (see Singarimbun, 1976, and Edmundson, 1977). This is not, of course, to deny that expanded economic horizons, a more complete monetization of exchange relations, and jobs located farther from home can yield subjective welfare losses unreflected in economic indices or in responses to artless questions about whether one is richer or poorer.

Social Organization and Local Administration

Social organization at the local level in Indonesia varies widely: in some regions (Java and Bali, Aceh, South Sulawesi), it is essentially territorial, with kin ties beyond the immediate family comparatively weak and villages consisting mostly of unrelated families; in others (much of the rest of Sumatra and North and Central Sulawesi, for example), kinship is a more salient principle of social organization, with clans or other kin groupings overlaying and sometimes forming the basis for territorial communities (see Ter Haar, 1962:Chapter 1; Ter Haar identifies more than 12 distinctive types of community organization in Indonesia).

Such differences, of course, are reflections of Indonesia's complex ethnic map. Fortunately, we need be concerned here only with the demographically dominant ethnolinguistic groups. Based on the 1980 rural population distribution according to language spoken in the home (Central Bureau of Statistics, 1982a:Table 10) these groups are as follows: Javanese (42 percent of the popu-

lation, mostly in Central and East Java, Yogyakarta, and the Sumatran provinces of Lampung and North Sumatra); Sundanese (15 percent, in West Java); Madurese (5 percent, in Madura and mainland East Java); Buginese and Macassarese (3-4 percent, mostly in South Sulawesi); Minangkabau (2.5 percent, mostly in West Sumatra); Batak (2.5 percent, mostly in North Sumatra); and Balinese (2 percent). In addition, there is a somewhat ill-defined group known as "coastal Malays," difficult to identify in the 1980 census, but who in 1930 were said to make up 7.5 percent of the population, mainly in eastern Sumatra and the coastal areas of Kalimantan (see H. Geertz, 1963), and the ethnic Chinese, perhaps 2-3 percent, dispersed chiefly in urban areas across the country. Of these, only the Minangkabau and Batak, and to a much lesser extent the Macassarese and Buginese, would be characterized by the potentially strong influence of an extended kin group on the behavior of individuals or families (see Kahn, 1980; Singarimbun, 1975; Lineton, 1975; for overviews of Indonesian regional sociocultural patterns, see H. Geertz, 1963, and Peacock, 1973). Thus, weighting by population directs our attention primarily to territorial-based groupings.

In the Javanese areas of rural Java, the territorial unit that is the basis of face-to-face social relations and primary loyalties is the natural village or hamlet (pedukuhan, kampung), or a smaller and less-defined neighborhood group within it. Comprising perhaps one or two hundred households, the pedukuhan is described by Jay (1969:290):

> It is the smallest and most solidary of all Javanese governmental units. To each of its members it is the most important unit for social identification beyond the nuclear family, hearthhold, and household . . . . It has a name, a specific citizenry, a defined territory, a governmental apparatus, a certain amount of land, . . . and a number of spirits identified exclusively with the village.

Its cohesiveness may nevertheless be weak: C. Geertz (1963:103) compares the Javanese village to "the other formless human community, the American suburb." What corporateness does exist may be largely an outcome of hierarchical relationships within the village by social status and age. In most other regions of Indonesia,

natural villages of some kind are similarly found to be significant units of social identification: in some cases, as in Bali, still strong organic entities; in others, as in the Sundanese areas of Java, much weaker and perhaps also so (see H. Geertz, 1959; Palmer, 1959; Hofsteede, 1971). This variation in the nature of the local community is plausibly an important factor in explaining regional differences in the performance of development programs.

Whatever their prior strength, rural community ties could be expected to be loosened by the economic changes discussed above and by the greater geographic mobility of villagers in recent years. The areas of life in which community influence is felt are likely to be narrowed and traditional authority structures weakened. Specific evidence on such trends, one way or the other, is lacking, however. Migration to the cities, a drastic shift in community setting, is of course also relevant in this context: rural-urban migration has raised the proportion of the population in urban areas from 15 percent in 1961 to 22 percent in 1980. If the rural population had grown at the national average rate over these two decades, it would have been larger by 10 percent (11 million people) than in fact it was.

In contrast to local-level social organization, more is known about recent shifts in local administrative arrangements in Indonesia. The formal administrative hierarchy is set out in Table 7. At the lowest level in rural areas is the administrative village (kelurahan, desa--the latter term confusing because the Javanese word desa means a pedukuhan), usually comprising a group of hamlets (perhaps 6-8 on average), sometimes clustered, in other cases strung out over a wide area. Its head, the lurah, is an elected official, although his term is indefinite, and in some regions the post is virtually hereditary. The higher administrative levels are headed by appointed officials (camat, bupati, and provincial governor). Roughly paralleling this civil administration is a military bureaucracy extending downward from the commander of each military district, the counterpart in the larger provinces to the governor.

Two significant changes have taken place in this system since the mid-1960s: first, a considerable strengthening of its role and an increase in its effectiveness qua administrative control, and second, devolution of responsibility for many aspects of development program performance to its lower reaches--kabupaten, kecamatan, and kelurahan.

TABLE 7 Administrative Levels, c. 1980: Indonesia

Unit	Indonesia		Java	
	Number	Average Number	Number	Average Number
Province	27	5,500,000	5	18,000,000
Second-Level Region[a]				
Kabupaten	246	500,000	82	950,000
Kotamadya	49	300,000	19	400,000
Kecamatan[b]	3,144	40,000	1,445	60,000
Kelurahan (Desa)[c]	54,000	2,000	20,000	3,500

Note: Usual translations of names of administrative levels: kabupaten = regency; kotamadya = municipality; kecamatan = subdistrict; kelurahan = administrative village, village complex.

[a]Excluding divisions within Jakarta.
[b]Excluding kecamatans within municipalities.
[c]Approximate numbers, excluding desas within urban areas.

Source: Central Bureau of Statistics (1979a, 1981b).

The first of these changes can be seen as a series of responses to the political events of the mid-1960s. A thorough shake-up in the civil bureaucracy, especially in provinces such as East Java and Bali where the Communist Party had been strongest, led to a greatly increased proportion of military men, both active and retired, in provincial and local government positions. In 1971, for example, all but seven of Indonesia's 26 governors and more than half of bupatis were reported to be military officers (Ward, 1974:2). The security concerns of the military hierarchy at all levels were intensified--toughening the civil bureaucracy, as Emmerson (1978:83) puts it, "with an exoskeleton of military command." Both civil and military administrations were enlisted in support of a new state party designed to establish a broad political base for the New Order government. The activities of other political parties were sharply curtailed; below the kabupaten level they were forbidden altogether except during election campaigns. The combined result was an administrative system much more able than before to translate government policy into action.

The second change, increasing local program responsibility, has been made feasible by this enhanced efficacy

and necessary by the mounting demands of the development effort. Indonesia has traditionally had a large array of line-ministry programs extending down to the kelurahan, each attempting to work independently. Sinaga et al. (1976) identified no less than 60 institutions, under 12 separate government departments, that in theory operated down to this level. While no single kelurahan has all or close to all of these institutions in operation, the scope for confusion and the work overload on local officials are evident. When the policy process no longer stops (as it used to) at the stage of planning and target setting but is concerned too with resulting performance, there is little alternative to devolution of program authority and local program coordination. Increased power of the administrative hierarchy at the expense of functional departments, with strenghthened roles for bupati and camat in particular, was thus to be expected. The programs that are the main success stories of the New Order government are those that have been able to work through or count on the active support of this hierarchy: the rice intensification scheme (BIMAS); the Kabupaten Development Program (INPRES--a public works/employment creation scheme financed by per capita grants to kabupatens; see Patten et al., 1980); and, as recounted in detail later in this study, the family planning program.

At the kelurahan level there has apparently been a diminution of consensual village politics, as the lurah and other village officials have taken on more administrative (and shed representational) functions. The lurah has always had high status vis-a-vis his constituents (and in Java usually is one of the largest landholders by virtue of the village-owned land that is put at his disposal in lieu of salary); since the 1970s he has tended in addition to become (de facto and in self-identification) a full-time government official, as the flow of development programs, instructions, and paperwork demands from higher levels of government has grown (see, for example, Sajogyo, 1973:65-66). The position of head of the pedukuhan or its equivalent (who is elected annually) seems to have weakened, becoming more that of administrative assistant to the lurah.

Despite rhetoric to the contrary, this trend towards cooptation of local community leaders into the national administrative system, with its characteristics of "top-down authority and one-way communication" (Emmerson, 1978:129), has moved Indonesia away from concepts of village autonomy and self-reliant development made

familiar from the experience of rural development in, say, Meiji Japan or contemporary Taiwan. Local leaders have been conditioned to look to outside, mainly government, assistance to stimulate "development"--in the form of funds, organization, and ideas.

Sociocultural Change

Systematic information on virtually any aspect of sociocultural change in Indonesia is lacking. For example, time series charting shifts in attitudes related to demographic behavior, available in profusion in many other countries, are scant. All we can do here is note the more tangible factors that appear to be influencing people's values and outlook on such matters, leaving to later an exploration of the likely direction of their influence (Chapter 4). Three factors stand out: the rising educational level of the adult population as a result of the expansion of the school system since the 1940s; the steady reduction of child mortality and hence, presumably, changing expectations about child survival; and increases in economic activity, in the spread of consumer goods, and in contact with urban consumption values since the late 1960s.

Literacy among the population 10 years of age and older was 47 percent in 1961, 60 percent in 1971, and 72 percent in 1980. Among the age group 15-24 years, the figure has risen over these two decades from 63 percent to 86 percent (Central Bureau of Statistics, 1963, 1972, 1982a). A recent comparison with other Asian developing countries is shown in Table 8: Indonesian literacy is now far above that of South Asia and not much behind that of the leaders. Table 9 gives a more precise picture of the growth of education over the last four decades based on current (1980) educational levels in the population. Although differential survivorship by education may exaggerate the actual proportions educated among the earlier cohorts, the general trend is clear: primary schooling expanded in the 1940s and 1950s, then plateaued through the 1960s--doing little more than keeping pace with the (admittedly rapid) growth of postwar birth cohorts; only well into the 1970s did significant expansion resume. This table shows too the nature of the sex imbalance: distinct, but at the primary level fairly small and declining. (1980 census data record equal school enrollment rates for each sex in the age group

TABLE 8 Indicators of Social Development, c. 1979: Indonesia and Selected Other Asian Countries

Country	Adult Literacy Rate (percent) c. 1977	Enrollment Rates[a] c. 1979 (percent)		Life Expectancy (years) 1980	Population per Physician (thousands) c. 1977
		Secondary School	Primary School Females		
Indonesia	62	22	89	53	14
China	66	79	114	64	1
India	36	27	63	52	4
Malaysia	60	52	92	64	8
Pakistan	24	16	31	50	4
Philippines	75	63	107	64	3
South Korea	93	76	111	65	2
Taiwan	82	76	100	72	2
Thailand	84	29	78	63	8

[a]Enrollment as fraction of relevant population age group.

Source: World Bank (1980, 1981, 1982b).

TABLE 9 Educational Attainment by Birth Cohort and Sex, 1980: Indonesia

Year of Birth	Percentage of Surviving Cohort Members Who Have Completed					
	Primary School		Junior High School		Senior High School	
	Male	Female	Male	Female	Male	Female
1925-30	35	29	11	8	5	3
1930-35	37	30	14	9	8	4
1935-40	49	38	22	13	12	6
1940-45	55	44	22	14	12	7
1945-50	60	49	26	16	16	9
1950-55	61	50	26	18	15	10
1955-60	63	52	29	19	16	10
1960-65	64	57	u	u	u	u

Note: u = not yet available.

Source: 1980 census (Central Bureau of Statistics, 1982a:Table 6).

7-12--both 84 percent [Central Bureau of Statistics, 1982c:14]; see also the comparative female school enrollment data in Table 8.)

The child mortality drop was mentioned earlier (see Table 3) and later used as a sign of improving welfare. Translating it into survivorship terms, in the 1960s one child in four on average died before reaching age 15; in the 1970s, the figure was one in six. While there is still far to go before a child's death will represent a rare tragedy in the average family's life, the improvement to date can already be expected to have modified subjective estimates of mortality risks. (The risks for those of higher income or educational status were already fairly low in the 1960s; see McDonald, 1980.)

Economic changes and the accompanying rise in geographic mobility, together with the post-1965 depoliticization of village life, have also been noted above. Modern consumer durables are increasingly found in rural as well as urban households: for example, according to the 1980 census, radios were owned by 57 percent of urban and 36 percent of rural households, televisions by 29 percent and 4 percent, respectively. (The latter figures are not much below the limits set by electrification: as of 1980, 47 percent of urban households had electric

lighting, but only 6 percent of rural households [Central Bureau of Statistics, 1982a:Tables 56, 58].) Shops in remote villages now stock cosmetics alongside their comestibles and patent medicines (see Singarimbun, 1978). Consumerist values seem to be blossoming, and not just within an economic elite.

However, some observers also see increasing anomie among the poor. In one far from scientific sampling of villagers' views of the future, the most characteristic descriptive word used was pahit (bitter).

CONCLUSION

The overall image of Indonesian development over the last 15 years is thus multifaceted. The impressive aggregate income growth was spread over most sectors of the economy and, at least by the late 1970s, had begun to benefit most of the poor as well as the better off. The employment picture is somewhat murky, especially in the large rural nonagricultural sector in Java and in the urban informal sector in the country as a whole. Employment seems, however, to have roughly kept pace with population growth, despite such structural changes as the displacement of female labor in agriculture by mechanization. Tight administrative control of the rural population has been exercised to maintain political calm--a condition in sharp contrast to the superheated political atmosphere prior to 1965. The same administrative structure has been wielded with substantial if selective success in promoting development programs. The fraction of the population with at least primary education has continued to grow, both from simple turnover and from further expansion of the school system. Three-fifths of the cohort born in 1960-65 completed primary school. Improvements in transport and greater media penetration of rural areas seem to be eroding rural-urban differences in values and consumption patterns.

As a summary and for later reference, some data on changing cohort demographic characteristics and experience in Indonesia for selected birth cohorts since the 1930s are assembled in Table 10. The rapid expansion in the numbers entering labor force ages in the 1960s--an increase of some 20 percent over that decade and a further increase of 35 percent in the 1970s--is especially notable. (This phenomenon, with its potential for inducing economic and political change, was pointed out by Keyfitz and Widjojo, 1964.)

TABLE 10 Selected Population Characteristics and Experience by Birth Cohort: Indonesia

Item	Year of Birth			
	1930-35	1940-45	1950-55	1960-65
Age in 1980 (years)	45-50	35-40	25-30	15-20
Average annual cohort size at birth (millions)	2.9	3.3	3.5	4.3
Proportion surviving to age 5 years (percent)	65	62	70	75
Average annual cohort size at age 15 (millions)	1.7	1.9	2.3	3.1
Proportion completing primary school (percent):				
males	37	55	61	64
females	30	44	50	57
both sexes	35	50	56	61
Average number children ever born per woman at age:				
25-30	u	2.90	2.54	u
35-40	4.84	4.94	u	u

Note: u = unavailable or not yet known.

Sources: Ratios of cohort sizes at age 5 from Feeney's age-ratios for 1971 and 1976 (Feeney, 1979a:Table 5); births from these ratios and West model life tables at levels assumed by Speare (n.d.), keyed to 1961 census population and 1961-70 vital rates (Table 2). Educational attainment from 1980 census (Central Bureau of Statistics, 1982a:Table 6). Children ever born from Table 5, adjusted for proportions ever married.

Given this background on the social and economic conditions within which Indonesia's demographic change has been taking place, the discussion now turns to a detailed examination of recent Indonesian fertility patterns and their immediate determinants.

CHAPTER 3

PROXIMATE DEMOGRAPHY OF INDONESIAN FERTILITY

Any summary measure of the overall fertility level in a population, such as the average number of children born to women by the end of their reproductive years or the crude birth rate, necessarily collapses a complex series of social and biological events occurring to individual women and the distribution of these events among women into a single index. For explanatory purposes at any level below a broad view of societal change over generations, the resulting information loss is critical. Conclusions on fertility determination may be reached that would be immediately falsified were the fertility process, mean and variance, laid out in detail. Having such detail, of course, does not ensure sound conclusions, but it does permit a much more precise linking of fertility to its socioeconomic and cultural setting.

This information loss may, however, be virtual rather than real. Instead of simply having to forage for the additional data among discarded materials, the more typical problem is that of gathering these data in the first place. In the Indonesian case, where simple estimates of total fertility are so often in dispute, knowledge of the constituent factors is particularly sketchy. This chapter first presents the estimates of total fertility and then assembles the available information on the major social and biological factors that directly govern fertility outcomes--marital patterns, practice of breastfeeding and postpartum abstinence, contraceptive use, and so on--what are now usually termed the <u>proximate determinants</u> of fertility. Finally, these two sets of information are combined using the simple but powerful accounting framework for proximate determinants developed by Bongaarts. This framework permits checks for consistency where information is relatively complete and inferences on missing estimates where it is less so.

The main statistical sources used are the 1971 census, the 1973 Fertility-Mortality Survey, the 1976 Intercensal Population Survey (SUPAS--the third round of which, known as the Indonesia Fertility Survey or SUPAS III, covered Java and Bali using the core questionnaire of the World Fertility Survey), the 1979 National Socioeconomic Survey (SUSENAS), and, to the extent its findings were available at the time of writing, the 1980 census. It might be thought that valuable supplementary quantitative information on fertility and its proximate determinants could be garnered from the various intensive village studies that have been conducted in Java in the 1970s--notably those of Sriharjo, Maguwoharjo, Ngaglik, and Serpong (see Appendix). However, problems of incompleteness and lack of comparability of data turn out to be considerable, and it has seemed preferable to use such studies instead mainly to provide a qualitative picture of local-level demographic behavior.

TOTAL FERTILITY

The overall picture of total fertility in Indonesia was summarized in Chapter 1. Table 11 expands this information, giving estimates from the main statistical sources named above, computed by the Cho-Grabill "own-children" method and the maternity history method for various time intervals. In all cases, single-year fertility estimates show somewhat erratic year-to-year variation and hence are averaged over several years in this and later tables.

In general, the present study relies on "own-children" estimates rather than those based on maternity histories. The former have been computed from all but one of the large enumerations in Indonesia from 1971 on, and the overlapping estimates from independent sources have shown good agreement. In contrast, the fertility time trends based on maternity histories are available from only two sources (the 1973 Fertility-Mortality Survey and the 1976 Indonesia Fertility Survey, SUPAS III), only the first of which gives nearly complete national coverage. Moreover, the overlapping estimates show some inconsistencies. McDonald et al. (1976:23) concluded their careful analysis of the Fertility-Mortality Survey fertility trend findings with the following cautious statement:

> The measured fertility decline in 1971-72 remains somewhat of a mystery. The explanation would

TABLE 11 Estimates of Total Fertility by Region, 1967-79: Indonesia

Region	Own-Children Method				Maternity History Method	
	1967-70	1971-75	1974-78	1976-79	1965-70	1970-74
Java	5.2	4.8	4.2	u	5.5	4.8
Jakarta	5.1	4.6	4.4	u	u	u
West Java	5.9	5.6	5.1	u	6.7	6.1
Central Java	5.3	4.8	4.3	u	5.5	5.1
Yogyakarta	4.7	4.2	3.6	u		u
East Java	4.7	4.2	3.4	u	5.1	4.3
Sumatra	6.4	6.0	5.1	u	7.2	u
Kalimantan	5.8	5.5	4.9	u	u	u
Sulawesi	5.9	5.8	5.0	u	6.7	u
Other Islands	6.2	u	6.0	u	u	u
Indonesia	5.5	5.1	4.5[a]	4.7	5.9	u

Note: u = unavailable or not yet available.

[a]Total fertility computed as a weighted average of the regional estimates is 4.6.

Sources: Own-children estimates: 1967-70, 1971 census (Central Bureau of Statistics, 1976); 1971-75, average of SUPAS I and II (Indonesia Panel, 1982); 1974-78, SUSENAS 1979 (Central Bureau of Statistics, 1981a); 1976-79, 1980 census (Central Bureau of Statistics, 1982b). Maternity history estimates: 1965-70, Fertility-Mortality Survey (McDonald et al., 1976:Table 3.10); 1970-74, SUPAS III (Indonesia Fertility Survey, 1978:Table 6.11).

> appear to be a compound of age misstatement, underregistration of births of young children and, in the case of Bali, East Java and urban areas of Sumatra and Sulawesi at least, some actual decline in fertility. The last factor can account for only a small part of the measured decline; the main explanation would appear to lie in an age misstatement and underregistration.

Indeed, the fertility estimates for 1971-72 for Java and Bali from the Indonesia Fertility Survey showed no radical drop, but rather a continuation of the moderate decline begun several years earlier. The authors of the Principal Report of this survey (Indonesia Fertility Survey, 1978:59), however, then introduced a very optimistic interpretation of the analogous drop found from their maternity history estimates for the years immediately before 1976:

> The Total Fertility Rate for Java and Bali has remained constant at around 5.5 throughout the 1960s. At the end of the decade a slow decline started and by 1972, the TFR had come down to around 5.0. After this the decline in fertility appears to have accelerated greatly and by 1974-75 the TFR was apparently approaching 4.0.

Belying this interpretation is an analysis of the same material by Feeney and Suharto (1980:4), which concludes that any fertility decline in Java and Bali in the decade prior to the 1976 survey "is small compared to the errors in the maternity history data and the decline is greatly exaggerated if the data are accepted at face value." Subsequent estimates of fertility from the 1979 National Socioeconomic Survey and the 1980 census reinforce these doubts about the Indonesia Fertility Survey's maternity histories.

Relying, then, on the series of "own-children" estimates, Indonesian total fertility in the late 1970s can with some assurance be put at around 4.7. A lower figure (about 4.3) is not impossible but the evidence for it--taking at face value the 1980 census-based "own children" fertility estimates for the period 1978-79--is weak. (See also the later discussion of consistency among the proximate fertility determinants.) The decline over the decade since the late 1960s was probably some 15 percent for the country as a whole and near 20 percent for Java

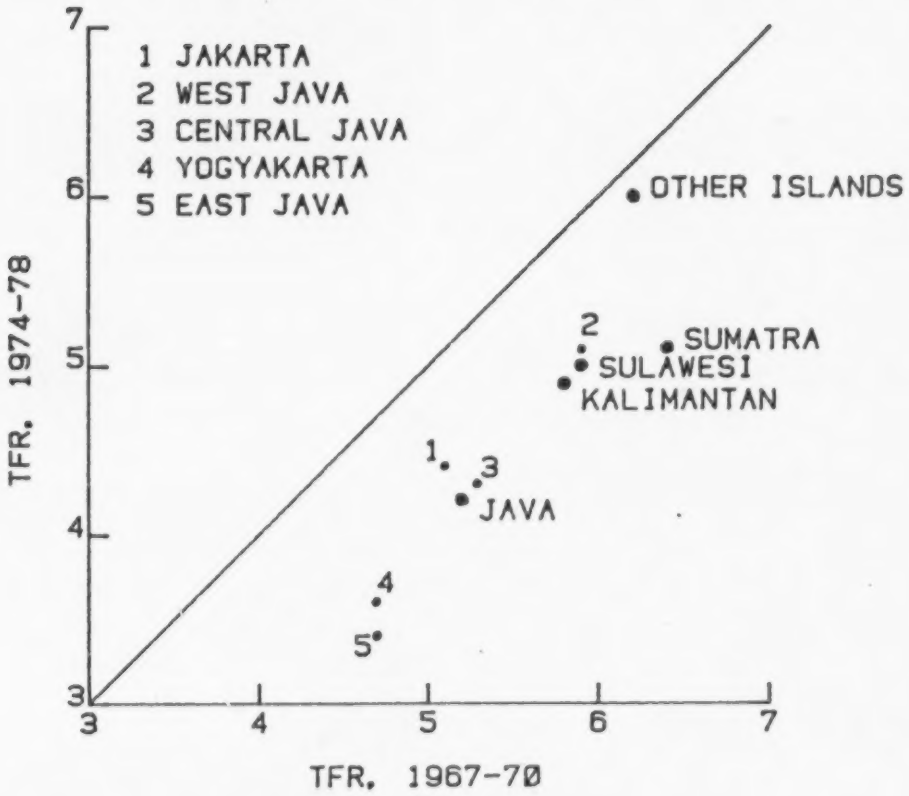

FIGURE 3 Total Fertility Rates by Region, 1967-70 and 1974-78: Indonesia

and Sumatra. In East Java, the fall appears to have exceeded one quarter; moreover, an independent fertility estimate from the first round (1980) of the East Java Population Survey (Sullivan, 1982) puts the 1979 total fertility rate for the province at 3.2, continuing the trend. Figure 3 charts the decline by major regions.

Urban and rural areas have participated about evenly in the decline, although in Java and Sumatra the urban-rural fertility gap (total fertility around 0.5 lower in urban than in rural areas) has slightly narrowed over the period. The age pattern of the decline can be read from Table 12. In the first few years of change, the fall was concentrated outside the prime child-bearing ages (20-34 years); in the mid to late 1970s a strong fertility decline persisted at ages above 35, and rates for women in the range 25-34 also dropped substantially. The

TABLE 12 Average Age-Specific Fertility Rates and Percentage Declines, 1967-79: Indonesia

Age Group	Fertility Rates (per 1,000) 1967-70	1971-75	1976-79	Percent Decline 1967-70 to 1971-75	1971-75 to 1976-79
15-19	138	121	114	12	6
20-24	266	256	248		
25-29	269	251	229	5	7
30-34	209	198	177		
35-39	142	119	103		
40-44	64	59	46	15	17
45-49	24	18	14		
TFR	5.56	5.11	4.66[a]	8	9

[a]The Indonesia Panel's tentative estimate, based on reverse survival from the 1980 census, is 4.91 (for 1976-78; the 1979 figure was discarded because of indications of age errors and omissions of young children in the census).

Sources: 1967-70 and 1971-75, average of SUPAS I and II (Indonesia Panel, 1982); 1976-79, 1980 census (Central Bureau of Statistics, 1982b:Table 2).

contribution to the overall fertility drop by women at ages 15-19 was 13 percent, at ages 20-34, 50 percent, and at ages 35-49, 37 percent.

Socioeconomic differentials in Indonesia's total fertility are distinctive: the highest fertility levels are found in the broad middle range of the status hierarchy (as measured, for example, by education of husband or wife). In the 1960s, for example, female elementary school graduates were estimated to have total fertility of 6.0 on average, compared to 5.1 for those who had not completed elementary school and 5.5 for high school graduates (Cho et al., 1980:51). Only for the tiny fraction of the population with tertiary education was fertility estimated to be lower than for those with no schooling. These differentials have been analyzed in detail by Hull and Hull (1977). The 1976 data on average parity of women by educational attainment and age group (Table 13) give a more recent picture confirming this pattern; it is also maintained under the substantially

TABLE 13 Average Number of Children Ever Born to Ever-Married Women by Age Group and Educational Attainment, 1976: Indonesia

Educational Attainment of Mother	Age-Group of Mother (years)			
	25-29	30-34	35-39	40-44
No school	2.8	4.0	4.9	5.1
Incomplete primary school	3.0	4.3	5.5	5.8
Primary school	3.0	4.5	5.3	6.1
Junior high school	3.0	4.0	5.3	5.7
Senior high school	2.2	3.6	4.7	5.2
Any tertiary schooling	1.7	2.4	3.3	3.8
All levels	2.9	4.2	5.1	5.3

Source: SUPAS II (Central Bureau of Statistics, 1978a:Table 5).

lower fertility now prevailing in East Java (Sullivan, 1982). Fertility decline within mothers' educational categories will be clearer when the 1980 census is more fully analyzed. Comparing the 1971 census and 1976 SUPAS II average parity data, the small 1971-76 declines noted earlier within the age groups 25-29 and 30-34 (Table 5) are entirely accounted for by women with no schooling or incomplete elementary school. The increase in average educational levels in the population has probably shifted as many women into as out of the educational categories that are associated (cross-sectionally) with higher fertility.

MARITAL PATTERNS AND MARITAL FERTILITY

A simple first step in identifying proximate fertility determinants is to separate out the effects of marital patterns and of fertility within marriage. In a working paper prepared for the Indonesia Panel of the NAS Committee on Population and Demography, McDonald (1979) assembled and evaluated the main sources of statistical information on Indonesian marital patterns prior to the 1980 census. The various survey estimates of marital status by age show many inconsistencies and erratic time trends; McDonald accords somewhat higher credence to the larger enumerations. The estimates from several of these are shown in Table 14. The time trend indicated is consistent with moderately increasing female age at first

TABLE 14 Percent Never Married for Females Aged 15-19 and Males Aged 20-24, by Region, Selected Years 1961-80: Indonesia

	Females Aged 15-19			Males Aged 20-24		
Region	1961	1971	1979	1961	1971	1979
Java	u	56	64	u	56	55
Jakarta	56	69	79	59	71	73
West Java	u	47	52	u	43	38
Central Java	u	60	68	u	57	60
Yogyakarta	75	85	88	69	78	77
East Java	44	55	64	62	60	58
Sumatra	u	70	81	u	62	65
Kalimantan	u	71	79	u	63	58
Sulawesi	u	76	83	u	60	60
Bali	u	81	85	u	59	60
Other Islands	u	74	92	u	59	77
Indonesia	u	62	71	u	58	59

Note: u = unavailable.
Sources: 1961, 1971 censuses; 1979 SUSENAS. 1961 data computed from available census tables (see Appendix); other estimates cited from McDonald (1979:Table 1) and Central Bureau of Statistics (1981a:Table 2).

marriage and approximate constancy in male age. Regionally, the female increase seems most pronounced in Java, Sumatra, and the eastern provinces (Other Islands), with Kalimantan joining the trend late in the 1970s.

SUPAS II and III contain specific information on age at marriage from direct questions on the subject, although responses in both cases need to be treated with caution because of possible dating errors. Median age at marriage estimates from the former source for women of three successive birth cohorts are presented in Table 15. The overall increase between women in their early 20s in 1976 and women in their 30s and 40s is little more than a year. The regional variation is broadly consistent with the marital status data in Table 14. The median age for urban areas (not shown, but given in McDonald, 1979) is some two years higher than that for rural areas, a gap that has been widening. The Indonesia Fertility Survey (1978:Table 4.1) also reported on median age at marriage, but for Java and Bali only. Its estimates, slightly lower than those in Table 15, locate the increase somewhat more precisely--beginning with the birth cohorts of the mid to late 1940s.

There are significant changes in marriage patterns that are not captured by the median data. One is a strong decline in female marriage at very young ages. The Indonesia Fertility Survey (1978:Table 4.1) records this for Java and Bali in 1976: up to the 1936-40 birth cohort, some 40 percent of women were married by age 15; for the 1951-55 cohort this fraction had droped to 24 percent, and for 1956-60, to 14 percent. The corresponding data for all of Indonesia (from SUPAS II; see Central

TABLE 15 Median Female Age at Marriage by Birth Cohort and Region, 1976: Indonesia

Region	Birth Cohort		
	1931-45	1946-50	1951-55
Java	16.5	16.9	17.8
Jakarta	17.7	19.4	19.6
West Java	16.0	16.3	17.2
Central Java	16.6	17.1	17.7
Yogyakarta	18.9	20.2	>20.5
East Java	16.5	16.9	17.8
Sumatra	18.1	18.5	18.7
Kalimantan	18.1	18.5	18.7
Sulawesi	18.5	19.0	20.4
Bali	20.7	20.4	20.3
Other Islands[a]	19.3	19.3	20.0
Indonesia	17.0	17.4	18.3

[a]See Appendix for limitations of survey coverage.

Source: McDonald (1979), computed from SUPAS II.

Bureau of Statistics, 1978a:Table 10) show a parallel decline, from around 20 percent for birth cohorts prior to 1940 to 8 percent for 1956-60. The drop reflects a shift away from parentally arranged marriages--often occurring several years before actual cohabitation. The first legal limitation on age at marriage dates only from the 1974 Marriage Act, which set minimum ages of 16 years for women and 19 years for men (Subadio, 1981:21).

The presence of a substantial and changing time delay between marriage and cohabitation makes marriage somewhat less proximate as a fertility determinant. Age at cohabitation is the more relevant index, and the time trend in this age is likely to track the time trend in age at first birth rather than in age at marriage. Age at first birth, at least in Java and Bali, remained virtually constant up to the 1951-55 birth cohort. The Indonesia Fertility Survey estimates by birth cohort are given by Pebley et al. (1982):

	1926-30	1931-35	1936-40	1941-45	1946-50	1951-55
Median	20.2	19.5	19.1	18.8	19.4	19.8
Mean	20.7	20.1	19.6	19.8	20.5	22.8

Related to the upward trend in female age at marriage has been a fall in the rate of divorce. Procedurally easy (especially for the husband) and in many communities not stigmatized, divorce is very common in Indonesia. The 1973 Fertility-Mortality Survey found that in Java, 24 percent of women were divorced within 5 years of marriage, 30 percent within 10 years; outside Java, the corresponding figures were 13 and 20 percent. Most divorces occurred early in marriage: the median length of first marriage for marriages that ended in divorce was around 2 years (see Soeradji, 1979:148-150). Very likely, a large proportion of these divorces were of early, arranged marriages.

The fall in the divorce rate is documented for Java, the region where it was highest. The 1973 Fertility-Mortality Survey for West Java, for example, shows about a one-third drop between prewar and postwar marriage cohorts in the fractions divorced at the same durations after first marriage (1, 2, and 5 years) (McDonald and Abdurahman, 1974). Outside Java the trends are less evident, although probably in the same direction. (Anecdotal evidence of an opposite trend in some regions of Sumatra is contained in Ihromi et al., 1973.)

Effects of marital instability on fertility, of course, depend on the degree and pace of remarriage. Both are high in Indonesia. The Indonesia Fertility Survey (1978:Table 4.5) found that, on average, women in Java and Bali spent 90 percent of their time since first marriage in the married state, a fraction that was fairly uniform across age groups and marriage cohorts; women with completed primary or high school education spent even higher proportions of time married--about 95 percent. (Somewhat higher proportions of reproductive time lost through divorce were observed in the Sriharjo study in Yogyakarta [see Chapon, 1976].) To the extent that infertility is a reason for divorce, the reassortment of partners may have a positive effect on fertility, compensating for some of the time lost.

Regional differences in age at marriage and proportions married in Indonesia do not conform to corresponding regional fertility differentials. The generally later

TABLE 16 Coale Indices of Marital Fertility (I_g) and Proportions Married (I_m) by Region, 1961-70 and 1971-80: Indonesia

	I_g		I_m	
Region	1961-70	1971-80	1961-70	1971-80
Java	.51	.44	.87	.82
Sumatra	.68	.57	.81	.77
Kalimantan	.61	.53	.81	.79
Sulawesi	.65	.59	.76	.73
Other Islands	.67	.65	.76	.74
Indonesia	.56	.49	.84	.80

Sources: 1961-70, Cho et al. (1980:Table 13); 1971-80, computed from 1979 SUSENAS and 1980 census data (Central Bureau of Statistics, 1981a, 1982a, 1982b).

female age at marriage found outside Java, for example, coincides with higher fertility in those regions. The Java-Other Islands gap in total fertility thus disguises a larger gap in fertility within marriage. In part, of course, this situation may simply reflect variation in the time delay between marriage and cohabitation mentioned earlier; regional differences in age at first birth might show less dissociation between late marriage and low fertility. However, the more important factors are probably real differences among regions in involuntary childlessness and in birthspacing intervals.

Regional differences can be conveniently summarized in terms of Coale indices, which decompose an overall index of fertility into multiplicative indices of proportions married (I_m) and marital fertility (I_g). (The indices are scaled from 0 to 1, with the upper limit corresponding to universal marriage throughout the reproductive years and marital fertility at the highest reliably documented rates--from the Hutterite communities of North America.) Table 16 presents these indices for the major regions of Indonesia in the 1960s and 1970s; the same information is charted in Figure 4, together with overall fertility (I_f, where $I_f = I_m \times I_g$) isoquants.

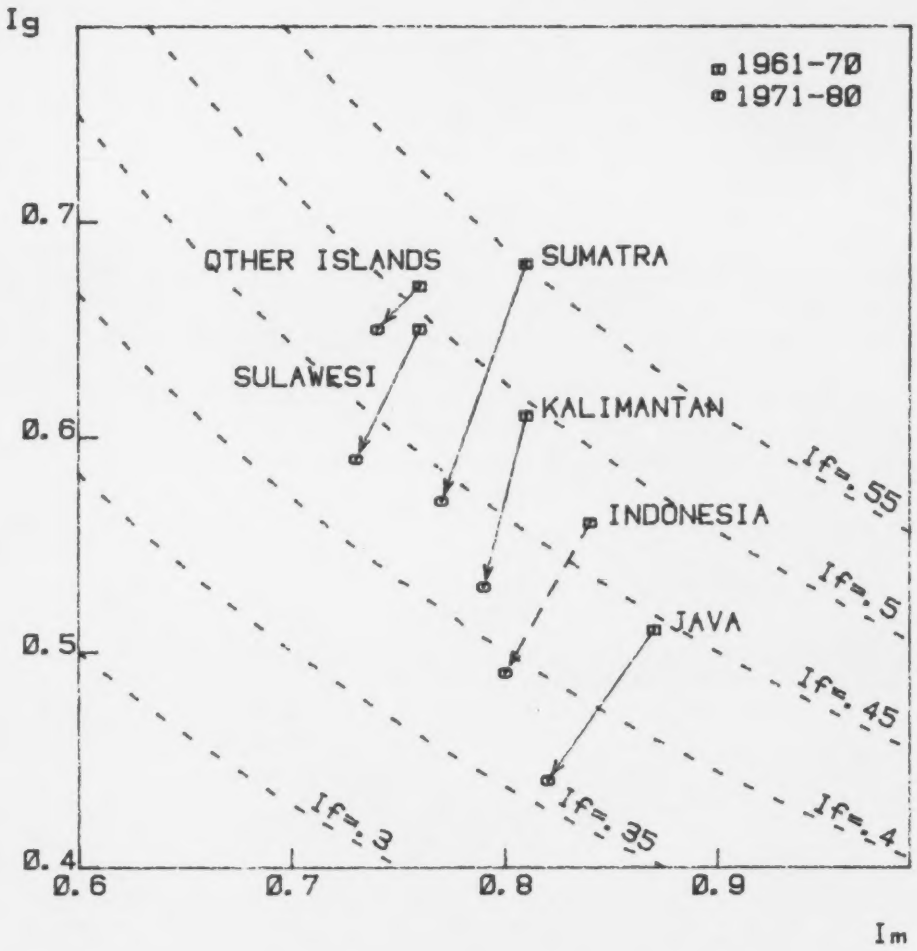

FIGURE 4 Coale Indices of Proportions Married (I_m) and Marital Fertility (I_g) for Major Regions, 1960s and 1970s: Indonesia

The regional patterns of demographic behavior seen in Figure 3 reflect both recent changes in social and economic conditions (discussed in Chapter 4) and differences in fertility and marital patterns existing prior to the onset of fertility decline. One source of these pretransition differences is to be found in ethnolinguistic divisions. The nine largest ethnic groups in Indonesia, together making up some four-fifths of the population, were noted in Chapter 2. The regional bases of these groups have been somewhat blurred by migration

and urbanization; however, except for the Chinese, "core areas" can still be identified--in some cases whole provinces. For Java and Madura, rough ethnic divisions can be drawn in rural areas at the kabupaten level. (Language data for small regions from the 1980 census will allow a fairly precise ethnic mapping; the same data at the household level will permit a systematic quantitative analysis of ethnic influences on fertility patterns to be undertaken. Pending these results, the conclusions drawn here must be regarded as tentative.) Fertility data that can be used to identify broad characteristics of the major groups have been computed from the 1971 census for the decade 1961-70 (see Central Bureau of Statistics, 1976). Of the eight major groups (excluding the Chinese), the Madurese show levels of marital fertility and proportions married fairly similar to those of the Javanese; the Minangkabau, Buginese, and Balinese resemble each other in these respects; and, with thinner evidence, the Batak and Coastal Malays are alike. Hence we are left with four patterns, qualitatively described in Table 17. The terms high, medium, and low in this table are used relatively: in many societies, for example, "low" proportions married would be an inapt characterization of a Coale index I_m value in the range 0.75-0.79; in Indonesia, however, the overall I_m value in the 1960s was 0.84, and only two provinces (Maluku and North Sulawesi) had I_m levels below 0.7 (Cho et al., 1980:42, 44). Regional and local-area fertility estimates do not throw any light on Chinese fertility in Indonesia. However, one demographic study of the Chinese in East Java (Pardoko and Indroes, 1974) indicated low levels of both overall and marital fertility in comparison to the East Java averages.

BREASTFEEDING AND POSTPARTUM ABSTINENCE

The potentially profound effect of breastfeeding on fertility is now widely recognized. The physiological link, through suppression of ovulation, is combined in many societies with a social link, through practice of sexual abstinence during lactation. In many cases both breastfeeding and abstinence are governed largely by cultural traditions and beliefs (not necessarily tied to fertility at all) and their associated normative pressures; they may also, however, be instruments of voluntary regulation of fertility by the woman or couple.

TABLE 17 Pre-Transition Fertility Characteristics of the Major Ethno-Linguistic Groups: Indonesia

Ethno-Linguistic Group	Approx. Percent of Population	Marital Fertility	Proportions Married	Total Fertility
Javanese Madurese	50	Very Low	High	Low
Sundanese	15	Medium	High	High
Buginese Minangkabau Balinese	6-8	Medium	Low	Medium
Batak Coastal Malays	10	High	Medium	High

Note: For marital fertility, I_g = .40-.49 (very low), .55-.64 (medium), >.65 (high); for proportions married, I_m = .75-.79 (low), .80-.84 (medium), >.85 (high); for total fertility, TFR = 4.5-5.4 (low), 5.5-6.0 (medium), >6.1 (high).

Sources: Provincial and kabupaten fertility data for 1961-70 from Cho et al. (1980:Appendix Table 8) and Central Bureau of Statistics (1976:Tables 1.1 and 2.1).

Hence an intricate mixture of "tradition-bound" and purposive behavior may lie behind the observed patterns, and in the latter case with the intent either of safeguarding the health of the child and mother or limiting completed fertility. To the extent that breastfeeding is deliberately used for fertility regulation, the standard and convenient definition of natural fertility--that which is not subject to parity-specific control--loses much of its intuitive meaning.

Despite its importance, information on breastfeeding in Indonesia is extremely sketchy. The main sources are the Indonesia Fertility Survey (SUPAS III) and a clutch of micro-level studies concentrated in Yogyakarta (and hardly any outside Java).

The Indonesia Fertility Survey (1978:Table 5.13) estimates for Java and Bali give a mean duration of breastfeeding of 19 months, with 20 percent of women reporting less than 12 months (including only 3 percent not breastfeeding at all) and 21 percent longer than 24 months. A third of the responses were heaped at 12 and 24 months. The median duration was 22 months, which compares, for example, to 31 months in Bangladesh, 19 months

in Pakistan and Thailand, 13 months in the Philippines, and 3 months in Malaysia (World Fertility Survey data cited by McCann et al. 1981). On the limited evidence of relative constancy of breastfeeding patterns in Java and Bali across age and parity classes, the Indonesia Fertility Survey Principal Report argued that there was no very distinct declining trend in breastfeeding practice in the years prior to 1976. This would contrast with the noticeable declines found, for example, in Thailand and Malaysia. However, Indonesia may not in fact be an exception to this familiar trend. The educational differential in breastfeeding--women with completed primary education have mean durations two months shorter than those with less schooling (Indonesia Fertility Survey, 1978:Table 5.14)--would tend to support a decline as primary education spreads. More directly, a shortening of the duration of postpartum abstinence, for which there is evidence (see below), would tend also, if it is not offset by contraception, to shorten breastfeeding by interrupting it with the next pregnancy.

Regional variation shows a mean duration of breastfeeding shorter by 1-2 months in West Java than in other provinces of Java and Bali (aside from Jakarta). In Jakarta and in urban areas generally, breastfeeding was considerably shorter (12-13 months) than the average for Java, and some 6-8 percent of women did not breastfeed. Outside Java and Bali there is no representative source of information on breastfeeding; it is reasonable to speculate, however, that on average the patterns there are closer to those of West Java than to those of the rest of Java and Bali.

On the subject of postpartum abstinence, survey data are not helpful. Recorded prevalence rates for abstinence as a contraceptive method can be given little credence (see below), and there is no survey information on durations. For the latter, we must rely on intensive village studies. Since most of these studies have been located in the areas of Java (notably near Yogyakarta) where abstinence seems to be particularly significant, there is little basis on which to make country-wide generalizations.

Some notes on the findings of selected micro-level studies in the areas of breastfeeding and postpartum abstinence are presented below.

• Maguwoharjo, a <u>kelurahan</u> 10 km east of Yogyakarta, 1972-73 (see V. Hull, 1975): The mean duration of breast-

feeding was 16 months (standard deviation, 6 months); of postpartum amenorrhea, 13 months; and of postpartum abstinence, 12 months. Seventy percent of women interviewed said their breastfeeding was for the health of the child only; 10 percent said it was for the purpose of spacing births; 14 percent said it was for both of these reasons. Both behavioral and attitudinal evidence points to a shortening of breastfeeding and abstinence periods (comparing younger and older cohorts). Following their first birth, women born in the 1930s breastfed an average of 15 months, women born in the 1950s, 12.5 months; for postpartum abstinence, the corresponding figures were 13 and 11 months. There was a similar strong age difference in proportions of women disapproving resumption of intercourse prior to weaning or to return of menstruation; for example, in the case of weaning, 79 percent of women born in the 1920s disapproved compared to 39 percent in the 1950s cohort. The gradient parallels and may be connected to a sharp drop in the belief that intercourse during lactation spoils the mother's milk: 40 percent of the 1950s cohort professed this belief, down from 85 percent for the 1920s cohort. Whatever the reason, the attitudinal shift presumably lessens the normative pressure for extended postpartum abstinence.

In addition to this apparent change over time, patterns of abstinence also vary systematically by socioeconomic status, whether measured by income or education. For example, mean duration of abstinence following the birth of a still-surviving child for two cohorts of women showed the following differences by income class (in months):

	Lower	Middle	Upper
1940s cohort	16	14	11
1930s cohort	19	16	13

• Sriharjo, a kelurahan 18 km from Yogyakarta, 1969-70 (Singarimbun and Manning, 1974): The mean duration of breastfeeding was 26 months (standard deviation 6 months) and of postpartum abstinence, 23 months (where infants survived). The reported period of amenorrhea was approximately equal to the period of breastfeeding for over half the women. For women whose infants were still living after two years, median durations of breastfeeding and abstinence by age group were as follows (in months):

	15-24	25-34	35-44	35-44
Breastfeeding	21.8	21.7	21.6	23.6
Abstinence	18.0	25.9	26.0	27.8

Both breastfeeding and postpartum abstinence durations were negatively associated with the wife's educational attainment. Mean durations in months were as follows:

Years of Schooling	Breastfeeding	Abstinence
0	26.3	24.3
1-3	22.3	21.8
4-6	21.7	19.3
7+	19.8	13.7

(The differences in part reflect time trends.) Similar but less pronounced gradations were found by economic status, but only slight differences by landownership. In all cases, the attitudinal data on ideal durations were consistent with the actually reported patterns.

• Ngaglik, a kecamatan 15 km north of Yogyakarta, 1976 (see V. Hull, 1978; Rens, 1980): A prospective study of breastfeeding determinants found the durations strongly negatively associated with mother's income and education, even when age was controlled. In turn controlling for socioeconomic status, the proportion of women who breastfed at least 24 months was 71 percent among those aged 30-39, 53 percent among those aged 20-29. The positive relationship with mother's age remained after controlling for parity and contraceptive practice, suggesting that it was a time trend rather than a life-cycle effect. (Durations less than 18 months, however, were related to contraceptive use rather than to age.) There was a divergence between declared and actual length of postpartum abstinence, the former apparently reflecting cultural traditions. The evidence suggested "that the cultural mechanism of sexual taboos might be more significant in determining birth intervals than the physiological factor of ovulation postponement due to lactation" (Rens, 1980:149). Motives for abstinence were about equally divided between lactation taboos and intentional birth spacing (V. Hull, 1978:Table 4).

• Cermee and Duduk Sampeyan, kecamatans in East Java 30-40 km west of Surabaya, 1961 (see Gille and Pardoko,

1966): Among respondents in 10 sampled villages, 64 percent reported breastfeeding for 24 months or longer; most of the rest reported 12-23 months. Illiterate women averaged longer breastfeeding than literate women. Virtually none of the respondents said they had heard of birth-spacing methods; interbirth intervals nonetheless averaged 38 months, and the average preferred birth interval was about the same.

• Serpong, a kecamatan in West Java 45 km southwest of Jakara, 1972-75 (see Zuidberg, 1978): Median length of breastfeeding was 18 months. There was a relatively short duration of postpartum abstinence of 4-6 months (Singarimbun and Manning, 1974:76) and no taboo against resumption of intercourse prior to weaning.

• Boyolayar and Kadilayu, kelurahans in Central Java, 1970 (see Yayasan Kristen, 1970-71): Median duration of breastfeeding was 18-24 months, with postpartum abstinence up to the end of weaning. Ideal spacing of children was three years, and a birth interval less than 18 months was considered to indicate a "shameful" lack of self-control. Abstinence was the chief method of birth control known (the study was undertaken prior to the start of the national family planning program) and was widely used for spacing, especially by the poor.

• Banyutowo and Karimunjawa, villages on the north coast of Central Java, 1975 (see Satoto, 1977): The mean length of breastfeeding was 24 months in both villages, with a standard deviation of about 4 months. There was an evident age gradient, possibly reflecting a time trend: women aged 20 years or below reported durations averaging 21 months, while women in their 30s reported 27 months. Similarly, illiterate women and those with less than primary school averaged 24 months, and women who had completed primary school, 21 months. There was almost no gradient by landholding. About one-fifth of the women gave the need to return to work as the reason for stopping breastfeeding; one-fourth stopped because of becoming pregnant again.

Based on these findings, the following general conclusions appear to be justified:

(1) Breastfeeding and associated postpartum abstinence are major determinants of overall fertility in Java and

possibly in the rest of Indonesia; they are probably also important in determining regional and socioeconomic fertility differentials. (Relative quantitative significance is discussed below.)

(2) There has been some decline in mean duration of breastfeeding, especially in the regions where durations were traditionally longest (Yogyakarta and Central and East Java); the scale of this decline is not known.

(3) Postpartum abstinence as a traditional child-spacing practice has been declining, in part with the rapidly expanding use of "modern" program-supplied contraceptive techniques and in part with the erosion of taboos (formerly strong in Yogyakarta and Central and East Java) against resumption of intercourse during breastfeeding. The extent of such decline would be clearly important for judging how much of the increase in contraceptive prevalence in the 1970s has been absorbed by substitution for traditional methods of birth spacing; unfortunately, this is not known.

(4) Duration of amenorrhea is largely a function of intensity of breastfeeding. Where, as in Indonesia, supplementary foods are introduced to infants early, a relatively simple relationship between lactation and infecundability cannot be taken for granted. In particular, it cannot be assumed that postpartum abstinence is redundant behavior in terms of its fertility effect where breastfeeding is practiced.

CONTRACEPTIVE USE

The most striking change in Indonesian demographic behavior over the post-1967 period is the dramatic increase in the use of modern methods of contraception. The programmatic organization that has ensured widespread availability of these methods and has encouraged their use through a broad range of conventional and innovative approaches is properly seen as a major accomplishment. This is examined in some detail in Chapter 4; for the present, our interest is in the bare statistical record of contraceptive prevalence.

The main data sources on the subject are various large-scale sample surveys conducted during the 1970s, the 1980 census (possibly the first anywhere to have had a question on current use of contraception), and the prevalence estimates constructed from service statistics and ad hoc surveys by the Family Planning Board.

In Indonesia as a whole in 1980, 27 percent of married women under 50 years of age reported they were currently using contraception, up from 18 percent in 1976 (see Table 18; a slightly higher proportion than the census figure was recorded in the 1979 National Socioeconomic Survey). The comparable figures for other countries in the region in the mid to late 1970s are as follows (World Fertility Survey data except where noted): Philippines (1978), 36 percent; Thailand (1975), 33 percent; Malaysia (1974), 33 percent; Taiwan (1977), 61 percent (Nortman and Hofstatter, 1980); and India (1977), 24 percent (Jain and Adlakha, 1982). In all these cases except India, more recent evidence shows further substantial increases in use rates in the late 1970s. Indonesia's trend in overall contraceptive use is similar to that of its Southeast Asian neighbors, but lagged by several years; its use rate now exceeds that of India and greatly exceeds that of Pakistan and Bangladesh.

As the earlier discussion of postpartum abstinence and breastfeeding may suggest, it is not altogether clear

TABLE 18 Percent of Married Women of Reproductive Age Reporting Current Use of Contraception, by Age, 1976, 1979, and 1980: Indonesia

Age Group	1976	1979	1980
15-19	7	16	10
20-24	17	28	23
25-29	24	41	34
30-34	24	40	36
35-39	22	36	32
40-44	15	25	24
45-49	9	16	16
All Ages	18	31	27

Sources: 1976 SUPAS II (Central Bureau of Statistics, 1978a:Table 18); 1979 SUSENAS (Central Bureau of Statistics, 1981a:Table 6); 1980 census (Central Bureau of Statistics, 1982a:Table 25).

whether respondents--and, for that matter, interviewers--would categorize traditional practices that have a known birth-spacing effect as "use of contraception." Presumably some would (and did, as the results classified by method show), while for others it is likely that the publicity given to program-supplied methods has caused those methods alone to be associated with contraception. When asked what methods of birth control they knew of, for example, married women of reproductive age interviewed in SUPAS II (1976) were most familiar with the pill (46 percent having heard of it) and to a lesser extent with the IUD and condom (25 percent and 20 percent); less than 2 percent professed knowledge of abstinence, 4 percent of the rhythm method, and 9 percent of any other "folk" method. No category of breastfeeding was used (Central Bureau of Statistics, 1978a:Tables 18, 23; see also the discussion of abstinence below). At the same time, however, there is anecdotal evidence (for example, the field studies by Ihromi et al., 1973) that suggests fairly wide awareness of traditional birth-spacing techniques throughout Indonesia. There is thus a substantial grey area in the interpretation of aggregate use rates, especially in measuring time trends.

Another caution should also be noted. Both the vigor with which the organized family planning program has been pursued in Indonesia and the emphasis it has put on achievement of targets in numbers of acceptors may have helped to create a climate in which survey responses on use rates are exaggerated. Especially with acceptance of oral contraceptives, but even with the IUD (the other main program method), recorded prevalence may not translate simply into couple-years of protection discounted by an appropriate failure rate. For the pill, failure rates computed from situations where user motivation is clearly strong overstate use-effectiveness in a less clear-cut situation. Evidence on these points is very sketchy. A precise knowledge of other proximate determinants and of fertility outcomes would of course settle the question, but this hardly exists in Indonesia. A crude test would be conformity with the international cross-sectional relationship between contraceptive use and fertility estimated by Nortman and Hofstatter (1980:94): using that relationship, an average use rate of 27 percent, the level found in the 1980 census, corresponds to a crude birth rate of 36 per 1,000, which may well be about the correct birth rate for Indonesia at the end of the 1970s. Detailed follow-up studies to investigate contraceptive use on a

case-by-case basis also help to clarify the issue. A study of this sort, conducted by Sullivan et al. (1974) in Mojokerto kabupaten in East Java, found continuation and pregnancy rates within the typical range of international experience; subsequent studies by the Family Planning Board suggest higher than average continuation rates (see, for example, Teachman et al., 1980).

The survey data on contraceptive use of course provide only snapshots of a rapidly changing situation. However, examination of the numbers and characteristics of women reported as current users and of the method mix is still useful. Proportions of users (among married women of reproductive age) by age are shown in Table 18. The apparent increase in use in the late 1970s is striking, although the discrepancy between the 1979 and 1980 estimates--the former from the National Socioeconomic Survey, the latter from the census--suggests either some volatility in acceptance patterns or a certain shakiness in the data. (Where possible, the discussion here relies on the census results.) The age pattern is as expected; if it were adjusted for lower rates of exposure to risk of pregnancy at later ages, as can be done for Java and Bali in 1976 using the more detailed WFS schedule, it would very like parallel the WFS Java-Bali finding of relative constancy over age (above 25 years) in proportions of exposed women using contraception.

Contraceptive use rates are sharply higher among women who have secondary and tertiary schooling, but this has little quantitative significance because of the small numbers of women concerned. At the primary level and below, gradations in use are smaller but in the same direction (Table 19). For men the pattern is similar (Soeradji and Harijati, 1981:82). In contrast to this positive association of use rates with education, the association with economic status, at least in Java and Bali, is U-shaped. Moreover, the relationship is not an artifact of age or time differences: it appears to survive the more obvious statistical controls (Freedman et al., 1981). Interestingly, use rates in Java in the 1970s were higher in rural than in urban areas, although the gap narrowed later in the decade. (Outside Java, urban rates remained much higher than rural.) We return to these potentially significant differentials in Chapter 4.

Reported methods of birth control being used are given in Table 20. Just over half of women reporting any method specified the pill; sterilization is notable for its near

TABLE 19 Distribution of Women and Proportion Reporting Current Use of Contraception, by Educational Attainment, for Married Women Aged Under 50, 1976 and 1979: Indonesia

Educational Attainment	Distribution of Women, 1979 (percent)	Proportion of Current Users (percent)	
		1976	1979
No school	35	16	26
Incomplete primary school	37	17	31
Primary school	21	22	36
Junior high school	4	31	45
Senior high school	3	41	51
All levels	100	18	31

Sources: 1976 SUPAS II (Central Bureau of Statistics, 1978a:Table 20); 1979 SUSENAS (Central Bureau of Statistics, 1981a:Table 7).

absence. (Among the small numbers relying on the latter method, seven times as many respondents in 1979 pointed to female as to male sterilization. Tan [1971] notes that there is a popular confusion of vasectomy with castration.)

There are wide regional variations in contraceptive use in Indonesia. In large part these differences reflect the uneven incidence of Indonesia's family planning program, which in its early years was concentrated on Java and Bali. Even within Java, however, provincial differences in use rates are striking and presumably are the product of more than simply program-related factors. The regional differences revealed in the various surveys over 1973-80 are shown in Table 21. For 1976, the Indonesia Fertility Survey estimates, in parentheses, are substantially higher than those from SUPAS II in Jakarta, Central Java, and especially Yogyakarta. It should be expected that the elaborate WFS schedule used in the former survey would yield better measures of contraceptive use. The discrepancies are not uniformly reduced if the WFS prevalence rates for current use of a modern contraceptive method (or current use of a "program method") are used instead in the comparison, but there is enough indi-

TABLE 20 Proportion of Married Women Aged 15-49 Reporting Current Use of Contraception, by Specific Method, 1976, 1979, and 1980: Indonesia

Method	Current Users (percent)		
	1976	1979[a]	1980
Pill	11	17	14
IUD	4	6	7
Condom	1	1	1
Other methods	2	7	5
Any method	18	31	27

[a]Four percent of married women aged 15-49 in 1979 reported more than one method currently used. Lacking further specification, these multiple users are included under users of "other methods."

Sources: 1976 SUPAS II (Central Bureau of Statistics, 1978a:Tables 18, 25); 1979 SUSENAS (Central Bureau of Statistics, 1981a:Tables 6, 9); 1980 census (Central Bureau of Statistics, 1982a:Tables 25, 26).

cation to suggest that confusion on this score in SUPAS II is the main source of the differences. In Yogyakarta, the higher WFS prevalence rate is nearly all accounted for by "traditional" methods.

The government's family planning program service statistics are another source of information on contraceptive prevalence--not wholly independent since they are periodically calibrated against survey results. In general the prevalence levels derived from service statistics, originating in the records of service providers, have more or less been borne out by later survey estimates of users (see, for example, the comparisons made in Sinquefield and Jones, 1976, and Sinquefield and Sungkono, 1979). As speculated earlier however, energetic program delivery efforts would tend to elicit inflated use-rate estimates; if this is in fact the case, it would be reasonable to expect service

TABLE 21 Percent of Married Women of Reproductive Age (15-49) Reporting Current Use of Contraception, by Broad Region, 1976, 1979, and 1980: Indonesia

Region	1973[a]	1976[b]	1979	1980[c]
Java	9	24 (26)	35	31
Jakarta	u	24 (28)	28	27
West Java	5	14 (16)	24	23
Central Java	9	21 (28)	35	31
Yogyakarta		21 (40)	39	39
East Java	12	35 (32)	47	38
Sumatra	3	5	20	16
Kalimantan	u	4	23	17
Sulawesi	4	6	31	25
Bali	21	33 (38)	46	21
Other Islands	u	u	13	
Indonesia[d]	u	18	31	27

Note: u = unavailable.

[a]Use-rates for Java exclude Jakarta and are for women aged 15-44.
[b]Figures in parentheses are 1976 World Fertility Survey estimates.
[c]Regional use rates computed using denominators from 1979 SUSENAS and then adjusted to make their weighted average equal the 1980 Indonesia use rate.
[d]See Appendix for limitations of survey coverage.

Sources: 1973 Fertility-Mortality Survey (Demographic Institute, 1974-75; Jones, 1977:35); 1976 SUPAS II (Central Bureau of Statistics, 1978b:Table 16; Chernichovsky and Meesook, 1981:Table A4); Indonesia Fertility Survey (1978:Table 5.6); 1979 SUSENAS (Central Bureau of Statistics, 1981c:Table 6); 1980 census (Central Bureau of Statistics, 1982a:Table 27).

statistics to be affected more than survey responses. Sometimes, moreover, use rates from service statistics are raised relative to survey estimates by adjustments to the denominator that narrow the definition of eligibility beyond the criteria of age and current marital status. The province where the program has reported greatest success, East Java, best illustrates the situation:

TABLE 22 Contraceptive Use-Rates from Service Statistics: Percent of Married Women Aged 15-44 Using Program Methods of Contraception, by Broad Region, 1971-81: Indonesia

Year	Java and Bali (1)	"Outer Islands I" (2)	"Outer Islands II" (3)	Indonesia (4)
1971	3			3
1972	8			6
1973	12			9
1974	17	2		11
1975	21	4		15
1976	24	6		17
1977	30	10		22
1978	37	11		27
1979	42	14	3	31
1980	44	16	5	33
1981	50	23	9	39

Note: "Outer Islands I" is the region to which the government family planning program was extended in 1971--Sumatra excepting Riau, Jambi, and Bengkulu; West and South Kalimantan; North and South Sulawesi; and West Nusatenggara. (The program began in Java and Bali in 1970.) "Outer Islands II," the remaining provinces containing about 10 percent of Indonesia's population, were brought into the program in 1979.

Source: (1) to (3) National Family Planning Coordinating Board monthly service statistics reports; (4) weighted average of regional use rates, assuming minimum use-rate of 2 percent.

service statistics for 1980 show a use rate (for married women aged 15-44) of above 60 percent; the 1980 East Java Population Survey (Sullivan, 1982) recorded 45 percent (42 percent for ages 15-49); the 1980 census in East Java found 37 percent for ages 15-49. With this caveat, the use rates for program methods of contraception (pills, IUDs, condoms) compiled by the Family Planning Board are given in Table 22.

OTHER PROXIMATE FERTILITY DETERMINANTS

Three other proximate determinants can be mentioned briefly: induced abortion, abstinence not associated with lactation, and subfecundity or sterility. The brevity of the discussion is dictated by the meager data available on these subjects.

Induced Abortion

Induced abortion is both illegal and culturally proscribed in Indonesia. Respondent information on the subject, as in many other countries, is widely and properly regarded with considerable skepticism by demographers. In a small number of studies, however, research conditions and researcher interests have been such as to lend credence to the findings. Two such studies are noted here, both in Yogyakarta Special Region.

In their 1969-70 study of Mojolama, Singarimbun and Manning (1974) conclude that there is no evidence to suggest that abortion is widespread. Attitudinal data showed greater toleration of abortion at lower economic levels (74 percent of women in landless families disapproving, compared to 92 percent in families owning 0.4 ha. or more), but no apparent efforts were made to invoke moral or legal sanctions against those known to have had abortions: "Despite general disagreement with abortion there was nevertheless a considerable degree of tolerance towards both those who executed abortions and women who terminated their pregnancies through abortion." It may be noted that abortion's legal status was not well known in the population.

The 1972-73 study of Maguwoharjo by V. Hull (1975) confirms the extreme sensitivity of the topic. Although some respondents knew of cases of induced abortion, no basis could be developed for quantitative assessment of incidence. Any impact on overall fertility levels or fertility differentials, however, was judged negligible.

Focus-group studies--structured informal discussions with small panels of respondents away from their homes (in settings in which respondents probably feel more anonymous than in a one-to-one interview)--offer another potential source of information. Results of a study of this kind in Jakarta (Suyono et al., 1981) suggest that a fairly wide knowledge of abortion methods might exist in the population; the study did not explore respondent views of prevalence.

Many hospitals in Indonesia routinely offer menstrual regulation procedures. They also, of course, treat abortion complications. Studies based on hospital records of abortion complications are consistent with a generally low but not negligible incidence of induced abortion, although ambiguities abound in these materials and interpretations of them vary quite widely (see the review by Utomo et al., 1982). Typical findings are noted below:

- Ujung Pandang (Sulawesi), 1972-74 (Sopacua et al., 1974): A study of hospital records of abortion cases over two years found 62 cases identified as induced abortions (treated for complications), although some of the other abortion cases, classified as spontaneous, may have been mislabeled. The majority of the induced cases resulted from treatment by traditional practitioners (dukuns); two-thirds were women of parity 4 or above (median age late 20s); most were women of "higher" socioeconomic status.

- Denpasar (Bali), 1979-80 (Surya and Manuaba, 1980): Records of some 1,000 cases of induced abortion complications over a 16-month period at a public hospital were reviewed. Half were attributed to delayed use of menstrual regulation procedures by general practitioners (it was not clear whether patient or physician was more often responsible). In most cases no contraception had been used; most women already had several children.

- Jakarta, c. 1975 (Rushwan et al., 1977): Women hospitalized for abortion complications classified as septic were considered most likely to have had illegally induced abortions. Based on 153 such cases, characteristics of women were as follows: median age, 27 years; median parity, 3.2; median number of living children, 2.9; proportion wanting no more children, 62 percent.

- In a larger study of kabupaten hospitals in Indonesia in the early 1970s, it proved impossible nine times out of ten to determine from the record if the abortion was spontaneous or induced (Soetopo, n.d.).

From the available data, the general conclusion can be drawn that induced abortion is not a significant factor in Indonesian fertility. However, this conclusion is tentative, and the subject warrants further investigation.

Abstinence

As a category, abstinence is an ill-defined area among proximate fertility determinants. Leaving aside postpartum abstinence (discussed previously), abstention from sexual relations to avoid pregnancy may be difficult to distinguish from involuntary abstinence through couple separation, and in its fertility effect, from the rhythm method of contraception. The Indonesia Fertility Survey did not separate postpartum from other forms of abstinence; in particular, it did not try to identify terminal abstinence, believed quite common in Java from the time a woman becomes a grandmother--as early as her mid to late 30s. Given its orientation toward contraceptive technique, the WFS schedule would tend anyway to underrecord behavior so enmeshed in cultural attitudes. For what they are worth, the Indonesia Fertility Survey results for knowledge and practice of abstinence and rhythm by married women in Java and Bali are as follows (in percent; Indonesia Fertility Survey, 1978:Tables 2.1.1, 2.3.1, 2.4.1):

	Abstinence	Rhythm
Heard of	12.8	11.7
Ever used	3.5	2.7
Currently used (among exposed women)	1.4	1.2

The data show no substantial increase in stated current use by age, suggesting either that terminal abstinence is not very important or, more likely, that its practice is not captured in the responses. (Analogous proportions both for Java and for all of Indonesia from SUPAS II and the 1979 National Socioeconomic Survey are lower still; see Central Bureau of Statistics, 1978a, 1981a.)

There is no reason to believe that involuntary abstinence has a significant fertility impact in Indonesia. The same improvements in transport and in general economic conditions that have facilitated short-term labor migration make extended absences unnecessary for the great majority of migrant workers.

Voluntary abstinence as a fertility depressant in Indonesia seems largely restricted to Central and East Java and Yogyakarta, i.e., to the ethnic Javanese. As noted earlier, it is being supplanted as a postpartum practice by modern contraception (though it is unclear

whether this is a "demand" phenomenon--for more convenient means of fertility control--or a "supply" effect of a vigorous family planning program tapping the most accessible part of its market). Whether other kinds of abstinence are being similarly affected is not known, but it seems likely that they are.

The contraceptive technique that most obviously meshes with abstinence is the rhythm method (see Singarimbun, n.d.). However, greater use of rhythm is not a family planning program goal in Indonesia--quite the reverse, in fact. The remarkable expansion of its use that has been observed in the last decade in the Philippines (and for which the Philippine family planning program, after reluctantly accepting it, has sought credit) does not seem to have a parallel in Indonesia.

Subfecundity

Among ever-married women in Indonesia at the later childbearing ages, some 5 percent were recorded in recent surveys as never having had a live-born child. The percentages by age were as follows (Central Bureau of Statistics, 1978a, 1981a):

	25-29	30-34	35-39	40-44	45-49
SUPAS II (1976)	8.2	5.8	4.9	6.4	7.2
SUSENAS (1979)	7.5	4.9	4.8	4.8	6.2

Considering the possibilities for error in household surveys, where the respondent may be answering for other household members, the results agree quite well. There are striking differences by region. In 1979, for example, Java and Sumatra showed the following patterns:

	25-29	30-34	35-39	40-44	45-49
Java	7.7	5.7	5.8	5.4	7.5
Sumatra	7.1	3.3	2.4	2.4	1.7

The other major regions were intermediate between these two, but closer to Sumatra than to Java (Central Bureau of Statistics, 1981a). A small part of these fractions may be accounted for by fecund women who were widowed or divorced soon after marriage and thereafter remained single, but that is a rare occurrence. For the most

part, the numbers presumably reflect female or male infecundity.

In a study of childlessness recorded in the 1971 census, T. Hull and Tukiran (1976) argue that many women for whom the number of children ever born was "not stated" were also in fact childless. Such an adjustment substantially inflates the census estimates of rates of childlessness (though not the survey-based percentages given above). Using as a summary index of primary sterility the age-standardized proportions childless (or not stated) among ever-married women age 30 and older, Hull and Tukiran found comparatively low sterility (below 10 percent) in Sumatra and most of Sulawesi, and comparatively high sterility in Kalimantan and Maluku. Java and Nusatenggara were both close to the country-wide average of 12 percent, but showed marked interprovincial variation: levels well above this average were recorded in East Java, Bali, and East Nusatenggara.

The Indonesia Fertility Survey in Java and Bali recorded respondents' self-reported beliefs about their fecundity by asking the following question (of currently married, nonpregnant women): "Do you think it is physically possible for you and your husband to have a child, supposing you wanted one?" Percentages reporting fecundity impairment among women in two age groups with no and one or more living children were as follows (Indonesia Fertility Survey, 1978:Table 1.3.2):

No. Living Children	25-34	35-44
0	13	38
1+	4	25

Reported infecundity was slightly higher than average in Central and East Java, slightly lower in West Java and Bali.

These large surveys can tell us little about what underlies such figures. The apparent regional differences in particular require further investigation, both to exclude possible data errors and to uncover the pathological factors that may be responsible.

In her study of Maguwoharjo in Yogyakarta, V. Hull (1975) found a substantial gradation in fecundity by income level--part of the proximate explanation for the positive association between fertility and socioeconomic status that is found at the low and middle status levels in Java. (Other parts of the explanation are differen-

tial durations of postpartum abstinence and patterns of marital instability, noted earlier). Hull and Hull (1977:54) speculate that the greater prevalence of infecundity among low-income women "may be due to deficient diet and higher incidence of disease among the poor, and particularly to their greater susceptibility to tuberculosis and venereal disease, which often go untreated. It may also be related to infections following childbirth; the poor are much more likely to have births attended by traditional village midwives than are the wealthy." In a village study in South Sulawesi conducted at about the same time, Lineton (1975) argued that the low completed fertility she observed was in part a result of ill health (especially malaria).

DISCUSSION

How consistent are the estimates of total fertility presented at the start of this chapter with the various conclusions drawn about specific proximate fertility determinants? This question can be investigated using the accounting scheme devised by Bongaarts (1978, 1982). Going beyond the Coale decomposition used in the earlier discussion of marriage patterns and marital fertility, Bongaarts' approach also decomposes marital fertility into components corresponding to the proximate determinants. The first step involves establishing a biological numéraire, the total fecundity rate (TF). Defined as the total fertility rate in the absence of reproductive time spent out of marriage and with no use of contraception, induced abortion, or lactation, total fecundity appears to be fairly uniform across populations. It averages approximately 15 live births per woman, although values ranging from 13 to 17 have been estimated (Bongaarts, 1978:Table 2). The procedure yields a decomposition of the difference between total fecundity and the actual total fertility rate into factors isolating the effects of the main proximate determinants. In their multiplicative form, these factors, known as Bongaarts indices, comprise indices of proportions married (C_m), contraceptive use (C_c), prevalence of induced abortion (C_a), and postpartum infecundability (C_i), constructed so that together they deflate total fecundity to total fertility. The intermediate points between the total fertility and total fecundity rates are the total marital fertility rate (TM) and the "total natural marital fertility rate"

(TN)--the latter defined as TM in the absence of contraception and induced abortion. Where, as in Indonesia, abortion can be considered negligible, C_a can be taken as unity. The simple decomposition identity is then

$$TFR = (TFR/TM) \quad (TM/TN) \quad (TN/TF) \quad (TF)$$
$$= C_m \cdot C_c \cdot C_i \cdot TF.$$

For Indonesia, the total fertility rate in the mid 1970s (1980 census "own-children" estimates for 1974-76) was 5.07. Total marital fertility, using proportions currently married from SUPAS II (Central Bureau of Statistics, 1978a) was 7.44, giving an estimate of C_m of 0.68. The contraceptive use rates by method from SUPAS II (Table 12), adjusted for effectiveness, yield an index of contraception, C_c, for the mid 1970s of 0.83. Finally, in the absence of indications that breastfeeding patterns are markedly different outside Java, we might assume mean and median durations of breastfeeding based on the WFS finding for Java and Bali of 19 and 22 months, giving an index of postpartum infecundability, C_i, of 0.58 (see Bongaarts, 1982:Table 3). This last index is the weakest empirical link in the chain.

These estimates can then be combined to give an implied total fecundity rate:

$$TF = TFR/(C_m \cdot C_c \cdot C_i) = 15.6.$$

An alternative method of estimating marital fertility, discarding the observed rate at ages 15-19 as being unreliable and inferring this rate instead from the age group 20-24, is recommended by Bongaarts; this procedure gives a total fecundity value of 14.5. In either case the implied total fecundity is centrally within the range of the empirically found levels. Considering the many uncertainties in the underlying data, this at least is an encouraging result.

We can now attempt to quantify the proximate factors behind the Indonesian fertility decline. Data on proportions married in the 1971 census and 1967-70 age-specific fertility rates from Table 12 yield values of TM and C_m for around 1970. For contraceptive use in 1970, an average use rate of 5-7 percent and average use-effectiveness of 80-90 percent would be consistent with the materials reviewed earlier (principally Tables 21 and 22), giving a C_c estimate of 0.94. Then on the assump-

tion that total fecundity remains constant at a level of 15.6 (constancy is reasonable to assume, and the precise level of TF does not affect the argument), the implied value of the postpartum infecundability index C_i for 1970 would be 0.54.

An increase in C_i reflects a decrease in postpartum infecundability: a drop of one month in average duration raises the index by about .02. The change from 0.54 to 0.58 over 1970-75 is thus consistent with our micro-study evidence on infecundability.

What can be said about shifts in proximate determinants over the second half of the 1970s? Proportions married from the 1980 census give a C_m value of 0.65. Contraceptive use in 1980, from Table 20 implies a C_c of 0.74. The 1970-75 decline in duration of postpartum infecundability very probably continued--perhaps raising C_i by the same amount over 1975-80 as over 1970-75; if so C_i in 1980 would be 0.62. Combining these values (and assuming the same total fecundity as before), we obtain an implied 1980 total fertility rate of 4.6. The time series then would be as follows:

	c. 1970	c. 1975	c. 1980
C_m	0.70	0.68	0.65
C_c	0.94	0.83	0.74
C_i	0.54	0.58	(0.62)
TFR	5.5	5.1	(4.6)

where the parentheses indicate a fairly high level of uncertainty.

There is, however, no direct evidence on recent levels or changes in infecundability. As an alternative, more conservative assumption, suppose that there was no change in C_i between 1975 and 1980. The estimate of C_m is reasonably secure; hence there would need to be a compensating adjustment in the 1980 total fertility rate in order to restore the accounting identity for that year. The 1980 TFR would be decreased from 4.6 to 4.3. Either of these values for total fertility is in fact entirely possible: the 1980 census estimate of the rate for 1978-79 ("own children" method) is 4.3 (Central Bureau of Statistics, 1982b), although this figure almost certainly understates fertility at that time (it incorporates a very low estimate for 1979, the year prior to the census). Independent information on fertility around 1980 from future demographic surveys will clarify this situation.

This area of uncertainty does not, however, affect the broad picture of the Indonesian fertility decline and its proximate determinants. Total fertility most likely dropped by nearly one child per woman between the late 1960s and the end of the 1970s. Falling durations of postpartum infecundability, ceteris paribus, would have raised total fertility over this period--probably by around 0.5 and possibly by as much as 0.7 or 0.8. The increase in female age at marriage was counterbalanced in its effect on proportions of women married by falling rates of divorce and widowhood. The net effect was a barely noticeable downward influence--taking off perhaps 0.1-0.2 from total fertility. The widespread adoption of modern contraception was the dominating influence: by itself, it would have cut total fertility by 1.5-2; in the presence of the offsetting infecundability effect, it could still account for nearly all the estimated 0.9 fall in total fertility.

This accounting for fertility does not address the important issue of individual intent. The low recorded level of contraceptive use in the 1960s does not necessarily reflect a near absence of parental actions taken to space births and limit their number, a point emphasized above in the discussion of abstinence. Many of the same uncertainties about the "naturalness" of pretransition fertility mentioned before with reference to nineteenth-century Java exist for Indonesia as a whole well into the 1960s.

CHAPTER 4

ANALYSIS OF FERTILITY DECLINE

We have seen, none too clearly, the proximate reasons for Indonesia's fertility decline. In light of the earlier discussion (Chapter 2) of the socioeconomic and cultural context, the purpose of this chapter is to go as far as possible toward explaining the decline. Limitations in our knowledge of the fertility determinants as a generic theoretical problem and of the specific empirical circumstances of the Indonesian case militate against reaching conclusive findings. We can, however, hope to narrow substantially the range of plausible explanations of the fertility decline thus far. There will inevitably remain room for argument over the detailed weighting of determinants.

Chapter 3 has set out the explicanda: an overall decline of some 15-20 percent in total fertility over the period from the late 1960s to the late 1970s, greater in Java and Sumatra than in the other major regions, mostly a consequence of lower marital fertility. Within marriage, the proximate determinants of the decline were a rapid increase in use of modern contraception in Java and, late in the 1970s, increasing use in other regions as well. At the same time, some part of this increased use substituted for or overlapped with traditional birth-spacing practices that were widely prevalent, especially in Java, in earlier periods. The available data do not allow more than a cursory locating of the fertility decline in socioeconomic and sociocultural terms.

The grist for an explanation of the course of fertility in Indonesia was assembled in Chapter 2, and we now examine from an explicitly demographic standpoint the patterns of change outlined there. Various possible organizing frames could be used to order such an

analysis. The NAS Panel on the Determinants of Fertility in Developing Countries has emphasized a framework in which the onset of fertility decline is seen as a shift from a regime of "natural fertility" to one of deliberate individual birth control by parents (Bulatao and Lee, 1983). Once within the calculus of parental choice, fertility responds to changes in parents' demand for children (itself influenced by child survival chances) and in the costs of fertility regulation.

The present study makes use of a somewhat different approach: fertility behavior is seen as enmeshed in an economic, social structural, and sociocultural matrix, varying as components of this matrix change. The domain of consciously adaptive behavior by individuals or couples may initially be very narrow (as in the case of natural fertility) or quite large, but is not assumed in either case to follow a prescribed course over time. Rather, it is seen as governed by the patterns of institutional and cultural change in the society--patterns that bring certain factors into apposition with fertility, but not others. Tracing these patterns is part of the analytical task. Moreover, different groups in the population, particularly as defined by culture and economic settings, may experience different kinds of fertility transition.

Three broad routes by which changes in socioeconomic and cultural context impinge on fertility can be distinguished (McNicoll, 1979): (1) through alterations in the array of economic benefits and costs associated with marriage and fertility; (2) through shifts in social or administrative pressures bearing on fertility-related behavior; and (3) through changes in people's internalized values concerning marriage, fertility, and family. (In practice, this three-way division is inevitably somewhat arbitrary.) For each of these routes, the discussion below explores, qualitatively and often speculatively, how the changes identified affect the nature of adaptive fertility behavior and fertility outcomes. The family planning program operates through all three, but because of its importance as a single programmatic entity is also discussed separately.

ECONOMICS OF FERTILITY

It is well accepted that fertility decisions have much to do with the economics of children--and indeed that the economic theory of the family, with its assumption of a

household production function, can yield important insights about how marital fertility behavior will respond to changing prices. For many, the current issues of contention concern not the reasonableness of this approach, but rather the significance of those dimensions of fertility that do not lend themselves to analysis in such terms. Historically, marriage rates, too, have been found to respond to economic forces in many populations: establishment of a new household has evident economic ramifications for the families of origin and for the couple itself; moreover, because children might become a burden on the community, marriage has also been seen as a legitimate object of public concern. In contrast to this, however, in most developing countries marriage is all but universal and for the woman takes place at a relatively early age; it is rarely seen by society as a feasible means of regulating fertility. For the most part, explanations for secular increases in marriage age and for other changes in marital patterns in these countries are probably better sought in long-run social structural and cultural change than in the economy. (There are some evident exceptions: in Sri Lanka, for example, the very late age at marriage in part reflects economic conditions; more generally, there is the effect on chances of widowhood as mortality falls--in part with economic growth.) This section, then, examines the changing economics of Indonesian fertility in terms of the economic values and costs of children and the costs of fertility regulation.

Economic Costs and Contributions of Children

From a base of virtually zero knowledge about the economics of children as recently as a decade ago, Indonesia has accumulated a respectable number of research studies. Notable among these are White (1976), T. Hull (1975), Sugito (1976, 1979), Saefullah (1975, 1979), and a broad study in the cross-national value-of-children format (Darroch et al., 1981); there are reviews of the subject in Hull and Hull (1976) and Meyer (1981). The regional concentration is the familiar one: predominantly Java, especially the area around Yogyakarta.

These various studies give a reasonably coherent picture of the economics of children in the 1970s, at least for rural Java. They all show that children start to contribute to the household economy from an early age through such tasks as housework, fodder and firewood

gathering, caring for livestock, and caring for younger siblings, often freeing adult household members for more productive work (see White, 1976; Saefullah, 1979). However, there is less agreement on the economic significance of this contribution when weighed against child costs.

What are these costs? The study by Sugito (1976) points to food as the main direct cost (as much as 75 percent of the total), with health, education, and clothing expenses also significant. The proportions would of course vary with income class. The formal costs of public schooling at the primary level are quite low (although fees are not adjusted to parents' income), but there are appreciable incidental expenses in the required purchase of school uniforms, shoes, textbooks, paper, and so on. These expenses figure heavily in the reasons parents give for children not going to school or dropping out. Moreover, for the Javanese at least, unlike some other societies (including some other groups in Indonesia) where extended kin ties are stronger, the extent of sharing of child raising costs beyond the nuclear family unit seems to be small (Sugito, 1979).

In contrast to direct costs, the opportunity costs of children to parents are probably slight throughout Indonesia. Child care by older children, neighbors, or relatives is easily arranged. The Value of Children survey conducted in Central and West Java in 1975, sampling currently married women below age 40, found only 3-5 percent of wives saying that the resultant greater difficulty of having a job was the most important reason for not wanting another child. Only 10 percent of wives in this survey said that children prevented them from working outside the home (Darroch et al., 1981:34, 38).

Calculations of net returns to children are highly intricate. White's (1976) study of the village of Kali Loro in Yogyakarta, the most careful attempt to compute these in an Indonesian setting, clearly illustrates the complexities entailed in valuing the diverse economic activities engaged in by children. On balance, in Kali Loro children seemed to yield a positive return. Studies elsewhere in Java, such as T. Hull's (1975) in a more prosperous village in Yogyakarta or Sugito's (1976) in Banyumas kabupaten in Central Java, reach opposite conclusions: that large families impose a substantial economic burden on parents at low- and even middle-income levels. In Hull's view, it is not numbers of children so much as their timing that determines the burden: "For

the poor parent the key to childbearing rationality lies in the maintenance of proper spacing between births so the burden of full dependency within the family is minimized" (T. Hull, 1976).

The economic balance is further complicated by the likelihood that children can serve certain insurance functions for the family in a risky environment and one with poorly developed capital markets and other financial institutions. Old age support, not as a routine matter but as a safety net in place, is prominent here (for example, see Saefullah, 1979; Darroch et al., 1981:Table 12). A more general family role in lessening economic insecurity is plausible, particularly in rural areas. However, the additional argument that Cain (1978) has made in the rural South Asian context--that older children may fill a vital security role in preserving family assets against the predation of others--seems less applicable in rural Indonesia. The formal legal system is comparatively strong; community norms of propriety may be eroding (see below), but still have effect; and the pervasive military presence provides another force for local order. It is not that the functional equivalent of social predation (for example, over land titles) never takes place, but rather that where it does, it is likely to have legal authority; the outcome would therefore not depend on the demographic makeup of a particular family.

Perceptions of economic values and costs of children by parents themselves might appear to escape these analytical intricacies, but questions on such matters have an unfamiliar starkness for most respondents that confounds simple interpretation of answers. The Value of Children survey did not attempt to weigh benefits against costs, but merely to investigate the comparative salience of various dimensions of each. Nevertheless, the survey does make clear that economic considerations are widely seen as important in the fertility calculus as a whole. Over two-thirds of the Javanese sample, both husbands and wives, cited tangible economic benefits (rather than "psychosocial" benefits such as companionship or family continuity) as the principal advantages of having children; more than one-third cited financial costs as the principal disadvantage. In both cases the fractions were considerably less among Sundanese respondents, but this was a much more educated and prosperous sample (see Darroch et al., 1981:Tables 6 and 13).

The various studies cited above give us little information about changes over time in the economics of children,

but the forces that must be bringing about such changes are readily enough seen.

• The decline in child mortality magnifies any net economic impact (positive or negative) of a given number of births, and at the same time lessens the expected net burden per child by lowering the risk of death--a factor that is likely to be taken into account implicitly in family planning. As Table 10 showed, the increase in the probability of surviving to adulthood has risen by some 20 percent in two decades.

• With the expansion of the educational system has come an increase in the educational attainment needed to have a good prospect for modern-sector employment. The government is the dominant employer of the educated labor force (data for 1976 show a total of 3.6 million employed persons outside agriculture who had junior high school education or above; civil servants at these educational levels numbered around 1.3 million, or about one-third of this total [Central Bureau of Statistics, 1980]). Even a low-level government position is seen as a guarantee of lifetime security and brings with it a higher status than most other occupations. In Sugito's (1979) rural Central Java sample, when village parents were asked what they wished their children to become, 40 percent said "government official." The competition for such jobs has intensified as the large birth cohorts of the 1950s (see Table 10) have entered labor force ages and encountered a government policy aimed at limiting civil service growth and upgrading the quality of entrants. As has happened elsewhere, schooling takes on elements of a job-rationing program. To some degree the private modern sector follows suit, for it too must choose entrants from the greatly enlarged youth cohorts. Thus the link between education and employment prospects outside the subsistence economy becomes a reality that parents have to face--a reality manifested in strong competition for high school (and a fortiori, university) places.

• The much improved economic conditions of the 1970s that benefited many families led to an influx of consumer goods and services, accompanied by media advertising to generate new markets for them. The result was a transformation of consumption patterns, as noted in Chapter 2. Rural as well as urban areas and low-income as well as middle- and upper-income families have been

affected. For fertility, the new goods and services in effect raise the relative costs of children, and the simple economic expectation would be for a downward shift in "demand" (see Lindert, 1980); analysis of the 1976 SUPAS II in fact shows a clear negative association between ownership of modern consumer durables and fertility, albeit in cross-section (Chernichovsky and Meesook, 1981:57).

• Accompanying the improvement in average incomes has been a series of changes in technology and institutions that have made working conditions more difficult for many people. Better transport has had a positive effect on labor productivity, but at the same time has broken down the boundaries of personalized local labor markets and eliminated many jobs that had grown up precisely because of transport inefficiencies. Lengthy commuting to work, from countryside to city as well as from the urban fringes, has become common throughout Java, with commuting time representing (as it does in the industrialized world generally) an invisible detraction from welfare. The seemingly inevitable counterpart to increased purchasing power and greater choice of goods is an increased need (genuine as often as artifically created) for the new expenditures. The impact on fertility suggested in the preceding point is thus likely to be amplified.

• A variety of technological and social changes have probably already begun to raise the opportunity costs of children for rural women. Agricultural tasks like harvesting and threshing, formerly the near-exclusive domain of women, have been transformed by new social arrangements (contract labor) and new equipment (sickles and mechanical hullers), cutting down overall labor demand and replacing female by male workers. Alternative employment outlets for rural women--market trading, urban domestic service, and commuting to jobs in the towns--are on balance likely to be less compatible with childbearing and early childrearing as well as with the casual minding of others' children. (For detailed studies of the degree of incompatability of some of these new occupations with fertility, see Partini and Peluso, 1977, and Rens, 1980.)

Fertility Regulation Costs

Prior to large-scale government distribution in the 1970s, commercially imported supplies of contraceptives (subjected to a heavy import duty) were distributed in Indonesia--sporadically, mainly in the cities, and at high prices--through pharmacies and private physicians (Singarimbun, 1970). From quite early in its history, contraceptive services and supplies delivered through the government family planning program in Indonesia have been free (aside from a "registration" fee charged to most clinic users). The effective monetary cost depends mainly on their accessibility to potential clients and on the cost of treatment of any side-effects.

In accessibility, until very recently the program has differed widely by region. In Java and Bali, some 2,000 family planning clinics were in operation by early in the 1970s. By 1977 each administrative village (kelurahan) had a Village Contraceptive Distribution Center. Increasingly, stocks were maintained in depots within each hamlet, further reducing any inconveniences of access (see T. Hull et al., 1977). In the other provinces, the program began later in the decade (see Table 22), extending to the so-called "Outer Island II" region, the final 11 provinces to be covered, only in 1979-80. By 1980 there were over 5,000 clinics nationwide, with an average 4,500 "eligible couples" (married with wife aged 15-44) per clinic in Java and Bali and 3,500 per clinic in other regions (Central Bureau of Statistics, 1980)--although in the latter case spread out over an area many times larger than the average for clinics in Java and Bali. The expansion of subclinic distribution centers and depots outside Java and Bali was continuing. Perhaps unique among government programs in Indonesia (and rare among family planning programs anywhere) this massive network has by all accounts been kept reliably supplied over the years. In the 1979 National Socioeconomic Survey Indonesia-wide sample, 80 percent of women who were current users of contraception said they could get family planning supplies in less than one hour, 94 percent in less than two hours (Central Bureau of Statistics, 198la:Table 13).

A potentially significant expense entailed in use of hormonal contraceptives or IUDs is treatment of side-effects. Such treatment, whether from a government health clinic or a private practitioner, is likely in practice not to be free. Moreover, the expansion of

health services has lagged behind that of family planning clinics and distribution centers: in 1976, according to data cited by Freedman et al. (1981), family planning services (if only from a depot or mobile team) were available in 94 percent of kelurahans in Java and Bali, whereas only 30 percent of "exposed" reproductive-age women lived in kelurahans where there was a health clinic or similar facility. With the family planning program's effort to move from its pill dominance toward IUDs, the absolute number of cases needing treatment may well have been rising. This is an area about which we have very little information, however.

While there can be no doubt about the very low monetary (direct and opportunity) cost of modern contraception for most of the population (excluding the small minority--less than 10 percent even in urban areas, according to the 1979 National Socioeconomic Survey--who make use of private physicians and pharmacies), there is little basis for estimating price elasticities of demand. What would prevalence rates be if users paid world market prices for contraceptives or if distribution were through the private sector and unsubsidized? We do not know. How much of the upward trend in use rates is attributable to the convenience and low cost of program supplies in comparison to preexisting alternatives? We cannot say. Research both on the characteristics and motivations of private sector clients and on the experience of commercial marketing of contraceptive products outside the government program would of course shed light on the subject.

SOCIAL AND ADMINISTRATIVE PRESSURES

The main spheres in which changing patterns of social and administrative pressures on families and individuals might affect fertility-related behavior are local government, local community, and family law. Local government is the arena in which official policy interests bearing on fertility are translated, whether effectively or not, into program action; the institutions of local government, together with those embedded in community arrangements, can constrain the scope of individual economic and demographic decision making; and formal legal dictates on marriage and family, while for the most part entangled in this local setting, have at least some residual influence on outcomes.

Local Administration

The toughening of Indonesia's local government structure in the aftermath of the 1965 coup attempt was described in Chapter 2. The government administration that many observers had seen as conspicuously weak and ineffective, loosely channeling downward a confusing and uncoordinated array of line-ministry activities, was transformed into a strong and, in some domains, single-minded instrument of central policy--initially with overriding interests in internal order and stability, but increasingly with broader development concerns. While line-ministry involvement continued, horizontal administrative divisions took on new significance: the roles of provincial governor, bupati, camat, and lurah were strengthened and assigned greater responsibility. Many positions in the civil administration came to be filled by former military officers, and at the kelurahan level by former NCOs; the parallel military hierarchy expanded its security functions. Both civil and military authority was for the most part unattenuated by cross-cutting political forces. Target setting had always been popular, but for the first time meeting targets became a serious activity and competition among local kelurahan, kecamatan, and kabupaten units was encouraged in a number of different program areas. A symptom of this new level of administrative intrusiveness is what a cynic has referred to as "statistical involution," the extraordinary efflorescence of recordkeeping at the kelurahan level over the past few years, with village statistics counting every duck, radio, and bicycle--and even the purported numbers of households practicing contraception--compiled on wall charts in the village hall for all to see.

Two demographic implications of these changes can be discerned, difficult to quantify though they are. Most evident of these is the capacity to translate the new top-level commitment to fertility reduction into similar commitment at the various levels of regional and local administration, combining unity of purpose with devolution of authority for effective action. The national family planning program, in consequence, could be energized by its close association with Indonesia's administrative structure. This effect can be seen most notably in the province of East Java, where rapid increases in prevalence rates for program-supplied contraceptive methods are partly attributable to the strongly supportive involvement of provincial and local government

officials. (The encouragement of this decentralization and local-government participation in turn owes much to the system of program management developed by the Family Planning Board.)

A less tangible but highly important consequence of the post-1967 administrative changes was a sudden quieting, in fact virtual halting, of village politics. Discussing the situation of the 1950s, Clifford Geertz (1959:40-41) argued that nationally based party politics gave to village life "an insupportably erratic and capricious quality":

> The extreme inconstancy and opportunism of Indonesian national political life keeps the village continually stirred up, continually uncertain of what to expect next, and so prevents it from stabilizing relations among alirans [cultural-ideological "streams"] within its own boundaries in such a fashion as to take full advantage of the organizational facilities they provide . . . . If some sort of fixed pattern can be impressed upon party politics at the top, then the promise of a new village society organized in terms of groups at once politicized and specialized, at once national and local, can, it is hoped, be realized.

Geertz was writing particularly of the Javanese village, but the picture seems to apply more generally. The continual stirring up that he describes also most likely precluded the kind of contextual stability needed for individual villagers to establish a fertility calculus based on a vision of future local economic realities, or for governmental population policy (had it been contemplated) to work through groupings at the village level or below. Over the past 15 years, during which time a "fixed pattern" of party politics has indeed existed, the salience of these economic realities for fertility decisions has been enhanced. Similarly, there was for the first time scope for efforts at local mobilization behind population policy goals. The depoliticization of village life helped to ensure that there was no misapprehension about the government's program goals in population and that there were no attacks of any consequence on the program on moral grounds (or on political grounds masquerading as moral).

Community Influence

A different kind of change in social pressures relevant to fertility behavior that has been taking place in Indonesia is an erosion of informal village authority structures. In Java, the increase in numbers of people commuting daily to work, even from fairly remote villages, was noted earlier in connection with its effect on the families concerned; its effect on communities may be equally pronounced, blurring village identities and narrowing their functions. While still far from creating the bedroom communities of modern western societies, the trend moves Java closer to, say, the Sri Lankan pattern of comparatively undifferentiated rural settlement, as well as to Sumitro's (1977) vision of Java's future as an island city. Other factors that are also weakening territorial-based social organization include the purchase of village land by city dwellers, the widening of income disparities among families, the greater exposure of rural youth to urban life styles and habits, and the present government's suspicion of virtually any spontaneous local organizing activity that is not within its control or directed toward its own program goals.

The term village is used loosely here. In Java, as noted in Chapter 2, solidarity would mostly be found at the pedukuhan (natural village or hamlet) level, or in even smaller neighborhood groups, and rarely for the kelurahan (administrative village) as a whole. The pattern, however, varies markedly in other regions, and much less is known elsewhere of changes currently taking place. (Bali, where hamlet councils, known as banjars, have acquired wide renown in population policy circles through their role in the provincial family planning program, is an obvious exception.)

What effects on fertility plausibly follow from these changes in community strength and function? The most immediate would be a decline in social pressures for conformity in demographic matters--principally on the questions of birth-spacing and early female marriage. The traditional view in much of Java that close spacing of births is irresponsible finds its support not in some abstract constancy of Javanese culture, but in the day-to-day slights that its violation would incur from neighbors and other community members. The social influence of people's views about birth-spacing, irrespective of how those views may be changing (a subject examined below), depends importantly on the strength of

the local solidary group. The same is true of social pressures on families for early marriage of daughters.

Another likely, though indirect, effect on fertility of a lessened community role follows from the greater economic autonomy of families. The rich are under less pressure (and have less need) to transmute part of their wealth into patronage; the poor have weaker claims on the better-off in the community for subsistence. Again, as in the case of the imposed political quietude, the economics of fertility come to the forefront in decisions about family well-being and about the separate best interests of husband and wife.

It is argued that the family planning program in Indonesia has acquired particular strength precisely by working through community groups--by drawing on existing community solidarities to reach target numbers of contraceptive users. Most of these efforts, however, seem more appropriately classed as drawing on existing administrative arrangements. The role of genuine community groups--women acceptors, mainly--is fairly modest (Bali again may be an exception), and is probably felt more in improving the quality of family planning services than in expanding their reach.

It may be noted that there are some countervailing directions of change tending to strengthen patterns of social conformity. In the more strongly Islamic regions of Indonesia--Aceh, much of West Java, northern East Java, South Sulawesi--religion plays such a role. If it is less a force on the national political scene, it may be more of one in many day-to-day activities. Islamic revivalism in the Middle East has resonances in Indonesia.

Civil Law

A third potential source of social-administrative pressure impinging on fertility decisions is the legal system. In matters pertaining to the family, Indonesia has a confusing overlay of traditional law (adat), varying by region, Islamic law, and Dutch-based civil law. The interplay of these codes and the gradual evolution of an "Indonesianized" national law are discussed by Lev (1972). In family law, an important stage in this process was adoption of the new Marriage Act in 1974 (see Katz and Katz, 1975, 1978). This law gives a prominent role to the civil courts in divorce and in so doing renders divorce more difficult than when it was governed for most

people by Muslim and adat law. The other main change incorporated in the Marriage Act, the fixing of minimum ages at marriage for men and women, seems in the near term unlikely to have much impact on actual practice: public knowledge of the law's provisions is scanty and enforcement slight. (The law also makes polygyny more difficult, but this practice was never common.)

Legally, contraception has remained in a cloudy area, but in Indonesia as in some other countries its formal legal status now has no practical significance. The one exception is sterilization, which has not yet been included in the national family planning program and is opposed by several influential Islamic groups (see Singarimbun et al., 1982). Abortion is a very different matter, however. There may well be increasing recourse to abortion as family-size variance decreases and as the perceived consequences of contraceptive failure come to loom larger to parents. However, there are no indications that legal abortion on demand is likely to come in Indonesia.

Finally, in contrast to those in most other Islamic countries, women in Indonesia are not legally (or extra-legally) disadvantaged in property ownership; this removes one potential source of insecurity and hence, it is frequently argued, one motivation for women to want early and high fertility. In many regions outside Java, traditional descent rules are patrilineal, and inheritance, still dominated by local adat law or by Islamic faraidl principles, disfavors women to some degree (see Suwondo, 1955; Ihromi et al., 1973). Increasingly, if slowly, however, inheritance everywhere is becoming bilateral as national civil code rules extend the domain of "modern" family law.

MENTALITÉS

If the factors discussed thus far exhausted the determinants of fertility, the task of analysis would be comparatively simple. They do not, however. Perhaps as important and probably more fundamental in influencing fertility is the way people think about children and childbearing--how they construe this part of their world. (This dimension, lacking a simple English term, is most simply described as mentalitiés.) How people construe their world, of course, is highly dependent on economic realities and on the constraints imposed by existing

social arrangements, but these tangibles are ordered and modulated by culturally rooted perceptions. In explaining the basics of getting a living, little may be lost in ignoring this dimension: a mounting body of evidence has shown behavior in that sphere to be in large part culture-free. Fertility, however, tied as it is to the central realities of social life and to people's intimate behavior, is altogether a different matter: if anything were culture-bound, this would be it.

But bound to what exactly? Three subject clusters are particularly relevant in setting the cultural context of fertility decisions. The first concerns individual autonomy and aspirations: What is the perceived scope of an individual's decision-making? Where does he see it constrained by family or civil authority or by the supernatural? What is his vision of the future along his own life cycle? The second concerns the image of the family that a person has internalized: the family's ideal make-up in terms of the numbers and timing of children, its economic role, expectations about relationships between spouses and between parent and child, and so on. The third concerns attitudes that bear on fertility regulation: the degree of awareness of the possibilities of regulation and beliefs about the legitimacy of such regulation, both in general and for specific methods.

Clearly, it is often difficult to say whether a particular fertility-related decision outcome (abstracting from the element of biological chance that is always present) owes more to such beliefs and attitudes or to concrete features of the social and economic environment. The two are linked, and the analyst's starting point is necessarily somewhat arbitrary. In accounting for time trends in fertility, as in other areas of behavior, more conviction usually attaches to socioeconomic explanations, with culture introduced as a residual factor; however, this reflects the comparative development of methods of analysis as much as judgment about the determinants of behavior. No attempt is made here to assign even a rough weight to changes in mentalités in the current Indonesian fertility decline. We can, however, suggest the ways in which ongoing patterns of social development are making for such changes, concentrating on the three content clusters described above.

Individual Autonomy and Aspirations

The impact of schooling on individual attitudes toward family, career, and authority is a common theme in

writings on social development. Many of the characteristics that have come to be used to define "modernity" at the individual level can be directly associated with school experience. In their classic cross-national study of six developing countries, Inkeles and Smith (1974:143) summarized their quantitative findings on the effects of education beyond "reading, writing, and figuring" as follows:

> Those who had been in school longer were not only better informed and verbally more fluent. They had a different sense of time, and a stronger sense of personal and social efficacy; participated more actively in communal affairs; were more open to new ideas, new experiences, and new people; interacted differently with others, and showed more concern for subordinates and minorities. They valued science more, accepted change more readily, and were more prepared to limit the number of children they would have.

There is every reason to believe that similar consequences are being generated in Indonesia as formal education reaches proportionately larger numbers in successive youth cohorts. We would confidently expect the higher fertility recorded for women with primary school education compared to those with no schooling or incomplete primary school (Table 13) to be a temporary feature of Indonesia's demography.

An additional factor in the Indonesian case, emphasized in the study by T. Hull and Singarimbun (forthcoming), is that most instruction in schools takes place in Indonesian, a language that many parents speak poorly or not at all. (The 1980 census records that 33 percent of the population 25 years and older cannot speak Indonesian; only 10 percent use it in the home; see Central Bureau of Statistics, 1982a:Table 11.) Attitudinal changes produced by rising school enrollments are thus the more likely to be felt as cohort effects over the lives of the children themselves rather than through changes in behavior diffusing through the whole society.

The spread of consumer values is another change affecting individual aspirations, this one not principally a cohort phenomenon. Widely remarked upon (and frequently deplored) within Indonesia, this is seen as a byproduct of New Order policies: an outcome, on the one hand, of the economic recovery and, for many, the

relative prosperity created by the oil revenues, and, on the other hand, of the government's encouragement of private economic activity and discouragement of political activity. The contrast with the economic austerity of Sukarnoist Indonesia (which derived as much from necessity as from ideology) is striking. The earlier discussion noted the likelihood of income and substitution effects bearing on fertility from the new array of consumption opportunities; the deeper change is in the implicit legitimation of consumption goals. The spate of advertising and exposure to American and other western film and television programs, in which Indonesia has rapidly been catching up to the conditions found in neighboring countries, is one source of legitimation. The demonstration effect of conspicuous consumption by the urban elite and an expanding middle class is another.

Image of the Family

If imported films and television programs convey Western consumerist values, domestic media productions tend to emphasize the turbulent effects of current social change on families. Without a formal content analysis such an observation is of course impressionistic; however, the themes of lessened parental control over children, of the increasing primacy of conjugal over other kin relations, and generally of the erosion of "traditional" family values occur repeatedly in film, radio, and print. Although such depictions reflect rather than initiate change, they are likely also to influence the expectations that people bring to family life.

Caldwell (1976) has argued persuasively in the West African context that the western nuclear family model is being insinuated into the patriarchal societies of that region through such means as school textbooks and popular magazines. In most of Java, families have been residentially and emotionally nuclear for generations (see H. Geertz, 1961; Jay, 1969), and no radical structural shift--for example, away from kingroup dominance--has to accompany a fall in fertility. In some other parts of Indonesia, where kinship ties beyond the nuclear family have traditionally been much stronger, the process of "emotional nucleation" probably still has far to go. (Residentially, many Indonesian households are lineally extended--that is, they include parents, parents-in-law, or grandchildren of the household head--but very few are

laterally extended; see Central Bureau of Statistics, 1982a:Table 4.) Throughout Indonesia, even in the patriarchal and matriarchal societies of Sumatra, parents have traditionally preferred balanced numbers of boys and girls, a typically "modern" pattern (see Indonesia Fertility Survey, 1978:74, for Java and Bali, and Ihromi et al., 1973, for Sumatra). There may well be a continuing gradual change in the balance of felt duties and obligations between parents and children in the latters' favor--an expected consequence, for example, of the expansion of schooling--although we would hesitate to describe this (except perhaps in some of the outlying regions) as a decisive Caldwellian "wealth-flow reversal" (Caldwell, 1982).

Aside from the "revealed preferences" embodied in actual family sizes, there is little evidence about changes in family-size desires in Indonesia. The Java Value of Children survey in 1975 examined preferences of both husbands and wives with considerable care, concluding that "the underlying preference structure was substantially and consistently toward families of four and five children." There was little indication of a decline, let alone signs of adoption of a two-child norm. Desired family size did diminish with shorter duration of marriage, but this simply reflected the expected correlation of desired with actual family size (see Darroch et al., 1981:66-67). The 1976 Indonesia Fertility Survey (1978:72) similarly found almost no association of desired family size with current age or marriage duration, once actual family size was controlled--indeed, the survey report concluded that there was "apparently no widely endorsed family size norm." Singuefield and Sungkono (1979) do, however, present slight indications of a decline from a comparison of the 1976 results with those of the 1973 Fertility-Mortality Survey.

In addition to revealing something about past preferences, the sizes of actual families in the community are also themselves an influence on attitudes toward family size. The average completed number of children (net of child mortality) presumably helps to set the common image of family life. The distribution of family size is relevant in assessing the degree to which a small family is a cultural innovation--whether it is the rare behavior of "demographic innovators" surrounded by a sea of high fertility or, by intention or fate, a commonplace. The Indonesian data suggest that a characterization of small families as innovative would be far-fetched: among ever-

married women aged 45-54 recorded in the 1979 SUSENAS, the percentage distribution by number of children still living was as follows (Central Bureau of Statistics, 1981c:Table 4):

0	1-2	3-4	5-6	7-8	9+
9	24	29	22	12	4

The median size is little more than three living children. The corresponding distribution of women aged 45-54 by children ever born shows that this dispersion is not simply a product of random child mortality:

0	1-2	3-4	5-6	7-8	9+
7	17	22	21	17	16

Perforce or by design, fully one-third of all ever-married women had no more than three children--this in the cohort whose childbearing was essentially completed before the recent fertility decline got underway.

Deliberate attempts to foster small-family norms are another possible source of attitudinal change. Compared to government program impact on contraceptive marketing or on the legitimation of birth control, government efforts to alter family-size preferences are especially hard to assess, but this does not mean that such efforts are necessarily ineffective. Their focus, after all, is directly on fertility outcomes rather than on means. In Indonesia the Family Planning Board, after some procrastination, has very recently embarked on a publicity campaign to promote the two-child family. The campaign's results may be intangible but the shift in emphasis it represents is significant.

Attitudes Toward Fertility Regulation

In the first major KAP survey undertaken in Indonesia, in Jakarta in 1968, three-quarters of both men and women (married and at reproductive ages) claimed not to know any method of fertility regulation (Suyono, 1974). Up to 1967 there was nearly complete public silence on the subject. Senior government officials expressed neutral, occasionally pronatalist, and almost always demographically uninformed views of population growth. The change

that took place over 1968-70 was profound: family planning emerged as one of the central issues on the agenda of the New Order government. President Suharto made repeated references in his speeches to the urgency of reducing fertility. The newly established National Family Planning Coordinating Board embarked on an intensive program of information, education, and communication activities, drawing on publicity methods proven elsewhere and on its own innovations. On billboards, at local meetings, in schoolrooms, in newspapers, on radio broadcasts, even in wayang (puppet) performances, messages urging adoption of family planning were inescapable. By 1976 three-quarters of married women under 50 in Jakarta said they had heard of at least one method of family planning, by 1979 over 80 percent. The same increase in declared knowledge occurred throughout Java and Bali, and, with some lag, in other regions as well. In 1976, "ever heard" proportions were 76 percent in Java and 51 percent in the rest of Indonesia; in 1979, the corresponding percentages were 83 and 67 (Chernichovsky and Meesook, 1981:Table A4; Central Bureau of Statistics, 1981a:Table 6).

Declared awareness of family planning methods and of the government's promotion of their use does not, of course, necessarily track individual attitudes toward those methods. The survey responses probably did not record traditional spacing customs routinely practiced but considered as something quite apart from the government's program interests. Moreover, the recent high levels of awareness may not be accompanied by similarly high rates of private approval. Even survey data on current use of contraception provide no sure minimum figure for approval--especially in a pill-dominated program such as Indonesia's. (A systematic replication of "focus-group" studies like that of Suyono et al. [1981], exploring views of particular methods of contraception, would be a valuable source of information here.) At the least, the publicity surrounding the family planning program has markedly raised the salience of decisions about contraception in most people's minds and has put modern contraceptive methods, particularly the pill, among the alternatives that can be routinely considered.

Finally, among relevant attitudes toward fertility regulation we should take note also of changing views about breastfeeding and postpartum abstinence. Among the poor, practice here may mainly reflect economic exigencies--more women have occupations that are incompatible

with breastfeeding, so durations are shortened and contraception may be used as a substitute in birth-spacing (Rens, 1980). For the better-off, Hull and Hull (1977:53) describe the attitudinal shifts bringing about changes in behavior:

> Ideas about 'proper' modern behaviour, the advertisements of powdered milk producers, and the advice of doctors trained in 'Western' traditions, have combined to influence young women to wean their children earlier. At the same time, changing ideas about the husband-wife relationship have led to the growing trend among women in upper and middle income groups to resume sexual relations earlier in the post-partum period.

ROLE OF THE FAMILY PLANNING PROGRAM

The above discussion of the Indonesian fertility decline over the last 15 years or so has repeatedly mentioned aspects of the organized family planning program: program effects on the economics of birth control (subsidization of contraceptive services), the program's links with local government and its use of community groups, and the explicit communication campaigns that have helped to legitimate contraception and to emphasize the national interest in lower fertility. It may be helpful, however, to say something about the program as a whole and its role in the fertility change.

We would note first that we have limited faith in statistical efforts to separate program impact from other (socioeconomic and cultural) factors as causes of fertility change. The conventional variables used to capture these factors differ in conceptual level and overlap in content. The problem is particularly acute in measuring program effort itself: decisions governing the availability of program services and even the level of overt political commitment to fertility reduction goals typically depend in part on the existing demand for birth control in the population. Moreover, a program's possibly large influence on service demand--perhaps its most important effect--is almost impossible to distinguish convincingly from the host of other plausible demand-influencing factors. Quantitative assessment of family planning program effect requires a proper experimental design--as, for example, was attempted recently in a

series of studies in Comilla district in Bangladesh (see Phillips et al., 1982)--but has not been undertaken in Indonesia. (The regional variation in Indonesia's program activity, however, does provide a crude quasi-experimental framework--see below.)

In Indonesia, this analytical problem is further complicated by the looseness with which program content is delimited. Is the mobilization of general administrative resources behind the low fertility goal properly seen as an element of "program effort"? A case can certainly be made for an expansive definition, but we then rapidly move far beyond common usage. The case of China provides an extreme illustration when the radical fertility decline of the 1970s is ascribed to "an effective family planning program" (see, for example, World Bank, 1981:109): effective, in its own terms, it certainly was; a mere family planning program in a sense recognizable elsewhere it was not.

The specific accomplishments of the government's direct involvement in family planning activities in Indonesia having significance for the fertility decline are (1) development of an effective contraceptive distribution system; (2) mounting of extensive information, education, and communications activities publicizing fertility and family-size issues and promoting the image of the small family; and (3) mobilization of local government and local community groups to bring informal pressures on eligible couples to practice contraception. Each of these has been discussed at various points earlier in this chapter. The first and second are the stock-in-trade of family planning programs everywhere, although they are areas in which Indonesia has performed particularly well; the third is the distinctive characteristic of the Indonesian program and its main source of interest to outsiders. (An additional point of interest is the management of the Family Planning Board--specifically, its avoidance of many of the bureaucratic inefficiencies of mainline government departments, and its impressive information system and research and training activities.)

The Indonesian government's commitment to birth control, though late in coming, was whole-hearted. Besides the Ministry of Health, the line ministry most directly concerned with service delivery, the Interior Ministry also became closely involved with program performance, and Interior Ministry officials--provincial governors, bupatis, and camats--were given responsibility for meeting target numbers of acceptors. Other Ministries (Infor-

mation, Education, Social Affairs, etc.) and private agencies (such as the Indonesian Planned Parenthood Association) undertook relevant specialized activities. The National Family Planning Coordinating Board, established in 1970 as an agency reporting directly to the President (and as such, with the same formal status as the National Development Planning Board) had the task of stimulating and coordinating these activities and aligning them into a coherent program.

In some regions the military bureaucracy also became involved in promoting birth control. The case of East Java, where the alliance of civil and military administrations behind family planning goals was most advanced, is discussed by Purbangkoro (1978): units of East Java's Brawijaya Division competed in annual "special drives" to achieve target numbers of acceptors of contraceptive supplies or services. The possibilities for coercion in such an involvement are of course obvious, but there is no evidence of physical as opposed to social or administrative pressure being used. As Purbangkoro (1978:68) puts it, the results were intended to be achieved "by confronting those reluctant individuals, whose initial resistance is so great as to block experimentation with family planning or with the IUD, with such overwhelming arguments, both verbal and symbolic (in the sense of demonstrating that family planning and acceptance of the IUD are approved, used and supported by those community leaders whose status and opinions have traditionally been influential in the life of the average villager), that the individual is compelled to accept because of the force of the arguments used." There are echoes here of the methods used to attain high contraceptive prevalence rates in China in the 1970s; nowhere in Indonesia's birth control program, however, have there been parallels to the excesses of India's Emergency or post-1980 China's "one-child family" campaign (cf. Gwatkin, 1979; Goodstadt, 1982).

Groups of female acceptors at the kelurahan or hamlet level have also played a role in maintaining contraceptive use rates in their communities. The interests of such groups often extend beyond family planning to health, nutrition, and other areas (rotating credit schemes are especially popular). Recurrent proposals in Indonesia for the family planning program to be "integrated" with health and other government program activities typically rely on this span of interests as the basis for integration.

The program's growth is recounted by T. Hull et al. (1977), and the details of program performance are recorded in numerous publications of the Family Planning Board (see the Board's technical report series--for example, Soetedjo and Parsons, 1977--and its monthly service statistics reports). The Board's administrative flexibility and willingness to innovative, evidenced by its encouragement of decentralization and its tailoring of program approaches to specific regional conditions, are discussed by Snodgrass (1979). The overall impact of the program on fertility is one of the issues taken up in the final section of this chapter.

DISCUSSION

This chapter has set out what have plausibly been the contributing factors to Indonesia's fertility decline over the past 15 or so years. Such a listing, of course, is not a satisfactory stopping point. It provides a surfeit of explanation, yet many questions remain open. For example, while the factors examined here may together have been sufficient to bring about the decline, can we say anything about their necessity? Under what modifications of the circumstances that actually prevailed would fertility have fallen faster--or earlier? To what degree has Indonesia's demographic experience been sui generis, and to what degree a response to regional or even global changes that in one way or another were bound to make themselves felt? Although such questions do not have straightforward or conclusive answers, they require discussion if we are to narrow the range of interpretations consistent with the findings presented here.

At the outset of this chapter, it was noted that different groups in the population (defined, for example, by cultural background or economic status) may experience different kinds of fertility transition. The weightings of the various fertility determinants posited above are unlikely to be uniform across all such groups; even if they were, variations in pretransition fertility levels by region and class (cf. Tables 11 and 17), and the defining characteristics of the groups themselves, would produce different demographic effects. Efforts to specify explanation by population group, however, very quickly come up against inadequacies in the empirical record.

Consider how to account for the regional pattern of fertility change summarized in Figures 3 and 4. The striking feature of this pattern is the extent to which major regions outside Java have participated in the decline. Comparing Java and Sumatra, for example, not only is the proportional decline in the total fertility of these two islands similar over the interval 1967-70 to 1974-78, but it is also similar over the two subintervals 1967-70 to 1971-75 and 1971-75 to 1974-78. Yet the family planning program was not extended to Sumatra until 1974, and two years later the Sumatran contraceptive use rate reported in the Intercensal Population Survey was only 5 percent--by which time in Java it had already reached 24 percent (Table 21). Two proximate factors plausibly make for this similarity of outcome: first, a larger effect of changing marriage patterns at early ages in Sumatra than in Java (fertility at ages 15-19 in Sumatra fell by one-third over the whole period, as contrasted with one-sixth in Java); and second, a smaller initial effect of contraceptive use on fertility in Java than in Sumatra as a result of a greater degree of substitution (of modern contraception for traditional methods of birth-spacing) in Java.

Is the currently higher fertility in regions outside Java a simple lag phenomenon, reflecting the several-years' lead that Java has in ready availability of modern contraception? There may be some lag effect involved, but we see the more significant basis for the gap in different courses of change in the demand for children. (Regional differences in involuntary childlessness also contribute.) Unfortunately, the variegation within each region limits the sharpness of the contrasts that can be drawn at this high level of aggregation. As factors giving rise to a demand gap between Sumatra and Java, for example, we might point to Sumatra's more heavily agrarian economy (as of 1980, agriculture was given as the main occupation of 65 percent of the labor force in Sumatra, 50 percent in Java), its less developed transport and communications systems, its generally stronger kin-group influence on nuclear family behavior, and its weaker traditions of deference to civil authority. However, to spell out such differences in the detail needed to tie them to fertility behavior requires further disaggregation--to the province level or below, and by cultural background--not possible with the data thus far available.

Just as changes in fertility in different regions may show distinct patterns of determinants, so, too, different

socioeconomic status groups in the population may experience distinct pressures for change. The likelihood of this is clear from the earlier discussion in the present chapter. The economics of fertility obviously differ over the income range; it would be disingenuous to believe that administrative pressures for use of modern contraception do not similarly vary.

In a study that seeks to explain differential contraceptive use rates found in the 1976 Indonesia Fertility Survey of Java and Bali, Freedman et al. (1981) suggest that two different processes are at work, one accounting for high use rates among people of high economic status (as measured by housing quality, ownership of consumer durables, or per capita consumption), the other accounting for the comparatively high use rates at the other end of the status distribution--a feature that "conventional wisdom" would not have predicted. The first process is seen as a straightforward "modernization effect" of education and higher occupational status in leading to rising levels of contraceptive use (p. 11). The second is more closely tied to the family planning program in its various dimensions (p. 15):

> [S]heer Malthusian pressure coupled with aspirations arising out of access to outside influences including the information and services of the family planning program may increase contraceptive use among the poor. . . . [I]t is possible that many poor people also adopt contraception because they find it difficult to resist the strong pressures of local officials to help them meet the mandated goals for local areas.

While clearly a simplification, this dual picture does capture some of the distinctiveness of the decline of marital fertility in Java.

Region (or better, culture) and socioeconomic status may be the most important divisions across which specific determinants of fertility change may vary, but there are of course others. Gender is an example: in many societies, arguably less so in Indonesia, changes affecting the economic position of women are thought to have been particularly significant in influencing fertility. In most societies, effects on fertility are probably also specific by age cohort: new cohorts with different experiences and hence different values move into the reproductive ages, and fertility patterns shift. In

Indonesia, women who were in the prime reproductive years (20-34) in the 1970s were born in the 1940s and 1950s; they and their husbands were better educated than previous cohorts--half or more of each sex had completed primary school, and a quarter of the males had finished junior high school, in both cases a steep increase from the 1930s cohorts; many more than before lived in cities; all were exposed in their youth to the ideology of the newly independent nation and its hopes for rapid economic development. Yet a simple cohort-turnover explanation of fertility decline cannot get us far in this case. Women aged 20-34 years in the 1970s contributed only half the fertility decline; older women showed a proportionately larger drop (see Table 12). Morever, the slight evidence we as yet have on the subject (children ever born by education and age of mother, for 1971 and 1976) locates most of the fertility decline among women with no education or incomplete primary school--precisely those who benefited least from the postcolonial expansion of schooling.

While as yet seriously impeded by data limitations, attempts at narrower specification of fertility determinants are one of the few ways we have of investigating necessary rather than sufficient conditions of fertility decline in a setting like Indonesia. On certain issues, however, counterfactual reasoning may add something--notably in trying to sort out which of the broad underlying shifts in Indonesia's circumstances since 1967 were most closely associated with demographic change. Recall these shifts:

- The radical change in political conditions that occurred over 1965-67 profoundly altered the national policy environment and the realities of local administration. Economic development was accorded central, almost ideological, status, and the pragmatic policy measures that were adopted to advance it (fertility control among them) brooked no political opposition.

- Following hard upon the successful economic stabilization measures introduced in 1967 was the strong export recovery, the renewed flow of foreign aid, and, in a few more years, the oil-price surge. Revenues poured into the government's hands, and Indonesia embarked on its first period of rapid economic growth since the early 1950s--indeed, in some sectors of the economy it was possibly the first period of positive net capital forma-

tion since before the Great Depression. While direct benefits were unevenly spread, by the end of the 1970s some improvement in real incomes was apparent among a large section of the population; for many the gains were dramatic.

- The political reorientation and economic gains together opened Indonesian society to a profusion of imported consumer goods and to more intense exposure to "western" cultural influences on consumption patterns and styles of living.

- Strong, top-level government commitment to a policy goal of lower fertility was translated into a vigorous family planning program which rapidly blanketed Java and Bali, and later the rest of the country, with a distribution network for modern contraceptives and with campaigns to promote their use.

In addition to these post-1967 changes, there was also the continuation of several earlier trends: steady growth of literacy and average educational attainment in the population, continued decline in child mortality, and fewer women marrying at very young ages. Moreover, the simple turnover of population was bringing the large 1950s birth cohorts into labor force and reproductive ages.

While many interesting counterfactual propositions concerning fertility determinants could be constructed from this array of factors, two broad questions particularly deserve attention: (1) What might have been the recent course of Indonesian fertility had there not been explicit and heavy government involvement in contraceptive promotion and delivery? (2) Could a substantial fertility decline have been set off earlier--say in the early 1960s or even in the 1950s--if a serious and competent family planning program had been mounted then? (India's program was begun, albeit slowly, in 1952.)

The first question leaves unspecified the critical issue of what the government's policy toward high fertility might have been in the absence of a family planning program. We take it for granted that Sukarno's pronatalism would have been reversed under virtually any circumstances. The obvious objectives of policy action would then have been to delay marriage and, directly, encourage small families. Achievement of the former, straightforward as it sounds, has eluded contemporary policy makers almost everywhere, although community control over

marriage and household formation was a routine practice in much of preindustrial Europe and Japan. In Indonesia the limited reforms enacted in the 1974 Marriage Law were made despite Muslim opposition that had defeated an earlier legislative effort. However, the option of mobilizing administrative resources behind late marriage presumably existed and could perhaps have been very effective. Certainly this policy route was not self-evidently more sensitive in the Indonesian setting than one based on promotion of contraception. Action directed at limiting family size without a primary stress on methods could also be envisaged: not only promotional campaigns like those lately adopted, but also decentralized targeting making use of the local civil administration much in the way it in fact was used to back the family planning program, except that fertility outcome rather than contraceptive acceptance would be the measure of achievement. However, while this would be potentially effective in fertility impact, the social cost of a family size policy could be high. The element of commandism built into the present family planning program is quite innocuous (pills are the dominant method, abortion is prohibited, and sterilization is not offered) in comparison to the possibilities for coercive pressures that arise under such an objective--and that have arisen under it in some other countries.

Would fertility have declined anyway in response to the changes in economy and administration that have taken place since 1967, with increased demand for modern contraception satisfied by the private sector and by the network of public health clinics? Many of the downward pressures on fertility identified earlier in this chapter are quite independent of the program, so there is little doubt that demand would indeed have risen and induced the growth of some kind of delivery network for services and supplies. The additional contributions that the government program has supplied (chiefly information, mass promotion, subsidy, and a target system) have with equally little doubt speeded the process, especially as it has affected the rural poor. A careful analysis of regional program incidence and fertility change at the province level will shed some more light on this question; its resolution in precise quantitative terms, however, is unlikely to be possible.

The second counterfactual concerned the putative impact of a family planning program established in the 1950s or early 1960s. Here our assumption must be that political

conditions somehow permitted its operation, although the effective administrative backing of later years would have been missing. The apparent extraordinary level of ignorance of modern contraceptive methods that prevailed in Indonesia until the 1970s (as documented in the "ever heard" survey data discussed earlier) could surely have been corrected a decade before. Whether a significant service demand would then have revealed itself is dubious, however. It was argued earlier that in most of Indonesian society, family patterns were not in themselves antithetical to low fertility--as contrasted, for example, with the situation that many observers see in Bangladesh, Pakistan, or some of the northern states of India. Yet high mortality, intense politicization of local issues, and the increasing shambles of an economy sliding into hyperinflation could hardly have provided a less favorable environment for fertility reduction. The circumstances would even have militated against a "poverty-induced" transition of the sort sometimes argued for Kerala or Tamil Nadu. On balance, then, it may be concluded that the onset of fertility decline in Indonesia was delayed less by the lateness of undertaking a family planning program than by the political turmoil and economic regression of that time. Either a coherent local administration or a steady economic course could have paved the way for demographic change; both in fact came with the New Order government.

CHAPTER 5

CONCLUSION AND PROSPECT

There would be little value in attempting to summarize the picture of Indonesia's fertility decline presented in Chapter 4. The patterns of change in the economics of children and fertility regulation, in social and administrative pressures on fertility decisions, and in the values people bring to this domain are intricate and, in their combination, unique to Indonesia. Glossing over this detail or packaging it into familiar broad categories may be necessary for comparative analysis, but detracts from understanding the particular case. The intent of this brief concluding chapter is to draw out the main implications of the preceding account for future Indonesian fertility trends and for certain aspects of population policy.

The most recent United Nations projection of Indonesian population growth over the next few decades is summarized in Table 23. This is the medium variant; the high and low variants span a range of 7 million people in 1990, 16 million in 2000, 27 million in 2010, and 38 million in 2020. We saw that the sharp decline in the growth rate in the 1970s, built into these projections, did not in fact materialize because of a faster-than-expected drop in the death rate. (Very likely such a decline in the rate of growth did begin late in the decade. Note, however, that current World Bank projections see an average growth rate of 2 percent over the rest of this century and a population at 2000 of 216 million [World Bank, 1982a:Table 17].) In any event, Indonesia's population most probably will have passed 200 million by the year 2000 and still be growing then by more than 2 million per year; with even less qualification, Java's will have passed 100 million before the end of the 1980s.

TABLE 23 United Nations 1980 Medium Variant Projection of Population and Vital Rates, 1980-2020: Indonesia

Item[a]	1980	1990	2000	2010	2020
Population (millions)	148	174	199	220	238
Growth rate (percent)	1.7	1.5	1.2	0.9	0.7
Birth rate (per 1,000)	34	28	23	19	17
Death rate (per 1,000)	16	13	11	10	9
Total fertility rate	4.6	3.4	2.6	2.2	2.0
Life expectancy (years)	48	53	57	62	66

[a]Rates refer to annual averages over the five-year period ending in the designated year.

Source: United Nations (1981).

The bland presumption of continued smooth and comparatively steep declines in birth and death rates in these projections is based on little more than faith and hope (safeguarded by the usual annotation that, despite this being virtually the sole use to which they are put, no prediction is intended). Drawing on the present study, can we find more solidly based assumptions about the future course of demographic change and, specifically, fertility trends?

Broadly determining that course will be economic conditions. Most observers expect Indonesia's impressive recent pace of economic growth to continue only a little slackened in the 1980s--provided the world recession ends and oil prices recover (see, for example, World Bank, 1982a). A real GDP growth rate of 7 percent per year, which doubles the total in a decade, is plausible under those optimistic provisos (the World Bank's "high case" projection is 7.5 percent). This would yield a per capita GDP for 1990 (in 1980 dollars) of around $700--about the level of the Philippines or Thailand today. In the 1990s, Indonesia is expected to become a net oil importer--known reserves are modest by Middle Eastern or Mexican standards and (subsidized) domestic consumption is surging--but most other primary product exports do not seem similarly constrained. The country's future in exports of manufactures is uncertain. Various other Asian nations, China among them, are likely to be strong competitors in moving into the labor-intensive manufacturing export industries (textiles, simple electronics, and so

on) as these are vacated by Taiwan, South Korea, Hong Kong, and Singapore. Moreover, mounting tariff barriers and advances in automation in the industrialized world may make this route of development much more difficult to follow than it was when those countries took it. Indonesia's potentially vast domestic market, on the other hand, can well support a large manufacturing sector, given protection, while the likely worldwide expansion of component subcontracting industries may provide appreciable export opportunities.

Whether this prospective economic growth, assuming it takes place, will benefit all classes in the population will depend critically on its employment dimension. In their study of recent Indonesian labor absorption, Mazumdar and Lluch (1980) concluded that economic trends in the 1970s were not moving Indonesia closer to the stage at which surplus labor is eliminated and real wages start increasing steeply--the "turning point" in Fei-Ranis growth theory, beyond which an economy emerges into the rich neoclassical era. The evidence on this critical issue is scant, however. Labor shortages that have sometimes been reported in rural Java in recent years are adequately explained by the seasonality and short-term nature of the work involved--hence competing poorly with more regular even if lower-paid activities--and poor information flows in the economy (Jones and Ward, 1981). On the positive side, improvements in government-supplied education and health services, an emphasis in the third Five-Year Plan (1979-84), have a direct if typically unrecorded distributional impact. Other government programs, particularly the series of labor-intensive public works schemes (INPRES programs), small-scale credit, and rural electrification, also contribute significantly to distributional as well as growth objectives. And while it continues (there are strong economic reasons against it), so does the heavy subsidy of the domestic price of kerosene, the basic fuel for the great majority of Indonesian households. Nevertheless, with the population at labor force ages expanding by 2.3 percent per year in the 1980s and the annual pool of labor force entrants increasing from 3.3 million in 1980 to 3.8 million in 1990 (and probably at least that number in 2000), the problems of employment creation confronting Indonesia's economic policy makers are extremely serious.

Assumptions about future economic growth and distribution are not enough to permit speculation on the course of fertility change. In Chapter 4, substantial emphasis

was also placed on patterns of social organization, on the role of local government administration, on certain aspects of cultural change, and so on--factors that were often tied only loosely to economic conditions, but that themselves strongly influenced the significance of those conditions for fertility. Most government policy that has an intended demographic impact is concerned with such factors.

On economic grounds alone, despite the various uncertainties, Indonesia's fertility decline would be expected to continue in the future. Competition to enter the high-wage, formal sector of the economy, especially through secondary and higher education, will maintain pressures for small families among the upwardly mobile; at least marginal improvement in economic levels but a more monetized, consumption-oriented environment will keep the economics of fertility salient for the poor. Among the growing urban and rural-but-nonagricultural population, rich and poor, these economics will probably (for the reasons discussed earlier) favor comparatively low completed fertility. Continued gains in child mortality will steadily raise the expected family size (and lower its variance) that results from a given number of births.

The economics of fertility depend also on the nature and scale of economic transfers within the family. In a society increasingly lacking other informal support networks, the family would retain an important role in income averaging and asset management over an individual's life cycle. At the same time, reliance on later returns from children may well become an unsafe assumption for parents. Current trends in actual and expected transfers in the case of Indonesia are largely unknown, however. Without more information on such trends, speculation about their fertility implications is unprofitable.

Continued local government influence is perhaps easier to predict. In the short run, little change can be foreseen in the firm administrative structure in Indonesia's rural areas. As noted earlier, this apparatus has contributed to the performance of the national family planning program and to certain other major development efforts. It has also quietened the political conflict that earlier may well have dominated views of the future and kept individual time horizons short. Arguably, however, it is less conducive to local economic enterprise (other than activities closely tied to itself). Local organizational initiatives--particularly among marginal farmers and landless workers--are unlikely to emerge, or

to survive if they did, in such an environment; yet, formal or informal cooperativization to promote the economic interests of that large segment of the population could make a major contribution to rural welfare in Indonesia. The report of the second Asian Agricultural Survey, for example, set store by "semi-spontaneous, small, primary organizations operating on the basis of direct participation and serving well defined common interests . . . [and able to] generate measurable private gains for their participants" (Asian Development Bank, 1978:228-229). The Indian Planning Commission's encouragement of this avenue of change in rural India is discussed by Krishna (1979). (The comparison of Indonesia with China is also instructive here: McCawley [1981:86] remarks that in China, production teams and brigades have a good deal of independence in production and investment decisions but within a government-controlled external environment, whereas in Indonesia, "the relationship between the scope for local decision making in rural areas and the wider economic and administrative environment is almost the reverse." Paradoxically, "although the indirect government control over the Chinese rural economy is quite pervasive, the hand of government seems to be more directly felt in rural Indonesia".) If the rural sector were merely engaged in, so to speak, a holding action until industrial labor absorption started to drive up wages, this would be a less serious issue. As noted above, however, that does not appear to be the prospect in Indonesia.

It it not inconceivable that the present espousal of consumer values in Indonesia, with its supports in advertising and the media, could at some point be sharply curtailed. Examples of such course changes exist elsewhere. Maintenance of the current situation, however, seems more likely--and with it, continuation of a downward influence on fertility.

The government family planning program can presumably continue to benefit from these various demand-creating forces while making its own contribution to service demand. The program's declared long-term strategy foresees the institutionalization of its low-fertility objectives through two processes: first, by "integration of the national population policy in the social, economic, cultural and developmental activities of all government programs"; and second (less evidently within the scope of deliberate government action), by "internalization within individuals and communities of acceptance of fertility

control and small families so that both ultimately become cultural norms and become socially sanctioned forms of behavior" (National Family Planning Coordinating Board, 1978:12).

This is not to suggest that the future course of fertility is somehow inherent in what has occurred thus far. To some observers, fertility decline, once well underway, appears to have its own momentum, feeding on itself and halting only with attainment of an average two- or three-child family. The less mysterious process outlined here, in which fertility patterns are tied to a particular social setting and fertility trends to shifting institutional arrangements and their economic and cultural counterparts, has no such certain outcome.

It is a curious reflection on the capriciousness (or short attention span) of the international population community that, although Indonesia's demographic transition has roughly paralleled India's over the last two decades (with East Java's present fertility on a par with Kerala's or Tamil Nadu's), Indonesia is hailed as a population policy success story while India is typically portrayed as a failure. The demographic similarity may well extend to the bases for some of the regional fertility differentials: the likelihood that most other Indonesian provinces will soon reach East Java's present fertility level may be no greater than that of the northern states of India soon reaching Kerala's. On the other hand, Indonesia's comparative economic vigor over the last 15 years and its distinctive administrative complexion may foretell an increasing divergence from "South Asian" growth patterns and a closer approach to East Asian models, with demographic patterns following suit. This study cannot hope to address such broad issues, but if successful, it will have suggested how fertility in particular is linked to that future course of development.

APPENDIX: DATA SOURCES

The following notes describe the more important of the primary statistical sources for the study of Indonesian fertility in the postwar period.

Population Censuses, 1961, 1971, 1980

The 1961 census, taken in October of that year, covered all Indonesia except Irian Jaya. Only a fraction of the planned tabulations were ever published and the worksheets for the remainder no longer exist. The only Indonesia-wide data it yielded came from an initial hand-count and a one-percent sample of the returns (see, for example, Central Bureau of Statistics, 1963). Neither of these included retrospective information on children ever born. Such data are available only for the three provinces for which full tabulations (based on 100 percent urban and 10 percent rural returns) were completed: Jakarta, Yogyakarta, and East Java.

The 1971 census comprised a complete enumeration in September and a more detailed sample enumeration in October. The latter included both household and individual questionnaires and had an overall sampling fraction of 3.8 percent. Total and age-specific fertility estimates based on "own-children" tabulations of this sample are given in Central Bureau of Statistics (1976); an analysis of these data is presented in Cho et al. (1980).

The 1980 census also was a complete count (September-October) followed by a sample enumeration with a much longer questionnaire (October), this time with a 5-percent sampling fraction. A 10-percent subsample of the latter was tabulated to provide the first results of

the census on fertility, including data on children ever born, "own-children" estimates of total fertility, and reported patterns of contraceptive use (Central Bureau of Statistics, 1982a, 1982b).

National Socioeconomic Survey (SUSENAS)

Begun in 1963-64, this series of large-scale surveys conducted by the Central Bureau of Statistics has been held every one or two years. Sampling fractions have all been about .001. The topical focus has varied from survey to survey and not all rounds had national coverage. Fertility estimates from most of these surveys are difficult to derive and are of poor quality. The 1979 survey, however, was a considerable improvement in this regard; detailed information from it (in most cases, combined with analogous 1978 results to give a greater sample size) are published in Central Bureau of Statistics (1981a). Results include "own-children" fertility estimates and elaborate regional tabulations of patterns of contraceptive use. The 1979 survey covered all provinces except Maluku (only Ambon and Maluku Tengah kabupaten), Irian Jaya (only 3 out of 9 kabupatens), and East Timor. (The effect of these omissions for Indonesia averages is usually negligible.)

1968 Jakarta KAP Survey

The first major study of family planning knowledge, attitudes, and practice (KAP) in Indonesia, this survey was conducted by a group associated with the Jakarta Family Planning Project in 1968; the analysis was done at the Community and Family Study Center, University of Chicago. For its findings, see Suyono (1974).

1973 Fertility-Mortality Survey

This survey, covering Java (excluding Jakarta), Sumatra, Sulawesi, and Bali (86 percent of the population) was conducted by the Demographic Institute of the University of Indonesia. The sample comprised 54,000 households. It produced fertility estimates based on maternity histories as well as data on marriage and contraception. Reports and analyses include Demographic Institute (1974-75), McDonald et al. (1976), and Soeradji (1979).

Value of Children Survey

The Indonesian Value of Children Survey was part of the second phase of the cross-national Value of Children Project coordinated by the East-West Population Institute, Honolulu. The survey, held in 1975, was undertaken jointly by the Population Institute, Gadjah Mada University, Yogyakarta and the Institute for Social Research, Padjadjaran State University, Bandung. The sample consisted of 2,000 wives and 1,000 husbands, split between Javanese and Sundanese regions of Java. Results are reported in Darroch et al. (1981).

1976 Intercensal Population Survey (SUPAS)

This elaborate three-round survey was conducted by the Central Bureau of Statistics.

SUPAS I (February-March) covered 257,000 households in all provinces (except East Timor), although rural areas of Maluku and Irian Jaya were not sampled and in East Nusatenggara only one kabupaten (Kupang) out of the 12 was included. Very limited information was sought, but enough to permit computation of fertility estimates based on the "own-children" method. The questionnaire is reproduced in Central Bureau of Statistics (1977); findings are reported in Suharto and Cho (1978).

SUPAS II (February-March) used a subsample of 60,000 households from SUPAS I with the same geographic coverage. A considerably larger questionnaire was used, seeking among other things information on marriage, fertility, and birth control. The questionnaire is reproduced in Central Bureau of Statistics (1977). Results are published in Central Bureau of Statistics (1978a, 1978b).

SUPAS III, the Indonesia Fertility Survey (April-May) also used a subsample of SUPAS I households, 10,500 in all, but in Java and Bali only. The questionnaire was essentially the core module of the World Fertility Survey, administrered to all ever-married women aged under 50 in these households. A full description and presentation of the main results are contained in the WFS Principal Report for Indonesia (Indonesia Fertility Survey, 1978); reliability is discussed in MacDonald et al. (1978).

Indonesia Fertility Survey

See 1976 Intercensal Population Survey

1980-82 East Java Population Survey

Undertaken by the Central Bureau of Statistics in collaboration with the International Program of Laboratories for Population Statistics (POPLAB), this is a three-round survey of about 20,000 households in East Java (1980 population 29 million). First interviews took place in May-June 1980 and were repeated 12 and 24 months later. The aim of the survey is to measure fertility and mortality rates in the province. Initial results were reported in Sullivan (1982).

Vital Registration Statistics

Birth and death registration in Indonesia, although legally required, is seriously incomplete and is not regarded as a useful source of information on fertility and mortality. A Sample Vital Registration Project covering 10 representative regions (usually kecamatans) during 1974-77 found only about half of births were being registered, with the proportion as low as 20 percent in some areas--and only 30-40 percent in Jakarta (see Central Bureau of Statistics, 1979b).

Micro-Level Studies

Indonesia has a quite rich collection of anthropological research, but there are comparatively few intensive local studies that are significant sources of demographic information. Those that are particularly relevant to a study of fertility--nearly all of them recent--are the following (names in some cases are pseudonyms; province location in parentheses):

Sriharjo (Yogyakarta)--Singarimbun and Manning (1974)
Kali Loro (Yogyakarta)--White (1976).
Maguwoharjo (Yogyakarta)--T. Hull (1975), V. Hull (1975).
Ngaglik (Yogyakarta)--V. Hull (1978), Rens (1980).
Serpong (West Java)--Zuidberg (1978).
Cermee, Duduk Sampeyan (East Java)--Gille and Pardoko (1966).

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COMMITTEE ON
POPULATION AND DEMOGRAPHY

Report No. 21

Levels and Recent Trends in Fertility and Mortality in Brazil

Panel on Brazil

Committee on Population and Demography
Commission on Behavioral and
Social Sciences and Education
National Research Council

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PREFACE

The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, and about the existence and extent of recent changes in fertility.

In 1963, a Panel on Population Problems of the Committee on Science and Public Policy of the National Academy of Sciences published a report entitled The Growth of World Population. The appointment of that panel and the publication of its report were expressions of the concern then felt by scientists, as well as by other informed persons in many countries, about the implications of population trends. At that time, the most consequential trend was the pronounced and long-continued acceleration in the rate of increase of the population of the world, and especially of the population of the poorer countries. It was estimated in 1963 that the annual rate of increase of the global population had reached 2 percent, a rate that, if continued, would cause the total to double every 35 years. The disproportionate contribution of low-income areas to that acceleration was caused by rapid declines in mortality combined with high fertility that remained almost unchanged: the birth rate was nearly fixed or declined more modestly than the death rate.

Since the earlier report, however, the peak rate of growth in the world's population has apparently been passed. A dramatic decline in the birth rate in almost all the more developed countries has lowered their aggregate annual rate of increase to well below 1 percent, and the peak rate of increase has also apparently been passed in the less-developed parts of the world as a whole. A sharp decline in fertility in many low-income areas has more than offset the generally continued reduction in the death rate, although the rate of population increase remains high in almost all less-developed countries.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the Committee on Population and Demography was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. The committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks; it initiated work on the third task in 1979.

The committee approaches the first task through careful assessment, by internal and external comparison, and through analysis, by application of the most reliable methods known, of all the data sources available. Each of the country studies therefore consists of the application of a range of methods to a number of data sets. Estimates of levels and recent trends judged to be the best are then developed on the grounds of their consistency and plausibility and the robustness of the individual methods from which they were derived.

The committee's second task, refinement of methodology, is seen as a by-product of achieving the first. The application of particular methods to many different data sets from different countries and referring to different time periods will inevitably provide valuable information about the practical functioning of the methods themselves. Particular data sets might also require the development of new methodology or the refinement of existing techniques.

The committee set three criteria for identifying countries to study in detail: that the country have a population large enough to be important in a world view; that there be some uncertainty about levels and recent trends of fertility or mortality; and that sufficient demographic data be available to warrant a detailed study. After a country has been selected for detailed study, the usual procedure is to set up a panel or working group of experts, both nationals of the country and others knowledgeable about the demography and demographic statistics of the country. The role of these panels and working groups, which generally include at least one committee member, is to carry out the comparisons and analyses required. A small staff assists the committee, panels, and working groups in their work. In a few cases, including the Brazil study, a staff member has undertaken primary responsibility for analyzing available data and preparing the report.

A total of some 170 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

Each country being studied has a different mix of data sources and different problems with data errors. Therefore, there is no standard pattern for all the reports. However, each report includes a summary of the main findings regarding estimates of fertility and mortality, a description of the data sources available, and a presentation of the analyses that were carried out, classified by type of data analyzed; detailed methodological descriptions are included where necessary in appendixes.

In some of the reports the estimates of fertility and mortality are presented as ranges. The use of a range is deliberate. It indicates that the panel and the committee are confident that the range includes the true value, but have concluded that the evidence does not warrant selecting a single figure as best. The range conveys an important aspect (uncertainty) of the estimation. Ideally, in constructing an average for several populations in each of which estimation is presented as a range, an aggregate range would be calculated (as the population-weighted average of the constituents). The user who selects a single figure from the middle of the range does so at the risk of misleading simplification.

This report, on levels and recent trends of fertility and mortality in Brazil, is No. 21 in a series of reports issued by the Committee on Population and Demography. The Panel on Brazil was organized in 1978. Following two panel meetings, in 1978 and early 1979, a draft report was prepared by Hania Zlotnik, a research associate on the committee staff, who used ideas and working documents provided by panel members. That draft report was extensively discussed at a workshop held in Brazil in May 1979, co-sponsored by the panel, the Associacao Brasileira de Estudos Populacionais (ABEP), and the Instituto Brasileiro de Geografia e Estatistica (IBGE). The Ford Foundation provided financial assistance for the workshop, which was attended by about 25 experts and officials concerned with demographic measurement in Brazil in addition to the panel members and two committee members.

Following the workshop, Hania Zlotnik extensively revised and updated the manuscript, drawing on the contributions and guidance provided at the workshop and subsequent contributions from panel and committee members. The committee's thanks are particularly heartfelt because Dr. Zlotnik voluntarily continued to work on and complete the report after she left the committee staff at the end of 1981 to take up new

responsibilities at the United Nations Population Division.

The committee is grateful to the IBGE for making possible the use of data from several censuses and national household surveys conducted in Brazil. Also, special thanks are due to Maria Helena Henriques and to Jose Alberto M. de Carvalho for their help in organizing the workshop; at that time they were, respectively, vice president and president of ABEP.

The committee also wishes to thank several other people who contributed in various ways. Katherine Miller Malin, edited the report, and Solveig Padilla and Irene Martinez assisted with typing the text and many tables. In addition to panel, committee, and commission reviews, Eduardo Arriaga provided a review of the report for the commission. Ken Hill, a member of the committee staff, provided helpful comments at various stages of the work, and Jane Durch, research assistant with the committee 1980-1981, helped with the computer analyses. The figures were kindly drawn by Susan Lapham, now senior cartographer at Geosciences Research Associates, Inc. Finally, Elaine McGarraugh prepared the manuscript for publication. For the contributions of all of these individuals, the committee extends its warm appreciation.

ANSLEY J. COALE, Chair
Committee on Population and Demography

SUMMARY

Brazil is the largest Latin American country in terms of both area and population size. Its population, approximately 119 million at latest count (1980), is distributed unevenly over its vast territory, concentrated mostly in the states bordering the Pacific Ocean and in the central region, still far removed from the Amazonian jungle. The diversity of geographic regions inhabited by the Brazilian population traditionally has been associated with an equally varied set of patterns of population growth. Thus, for example, while the country's most prosperous regions, Rio de Janeiro and Sao Paulo, have been characterized by relatively low fertility and mortality levels, not dissimilar to those observed in the wealthier countries of the region (such as Argentina and Chile), the Northeast still exhibits relatively high fertility and unacceptably high child mortality. Given the great regional diversity known to characterize the Brazilian population, this report investigates regional differences in both fertility and mortality and uses them as a basis for deriving estimates at the country level.

During the past decade Brazil has undergone at least two changes of great importance from a demographic perspective. First, the fertility decline that had already begun by the time of the 1970 census has continued at what appears to be an ever increasing pace. Second, official interest in the components of population growth and in their regional variations spurred the establishment of a household survey program which completed at least six nationwide surveys during the 1970-79 decade, all of which explored demographic characteristics of the population, among other topics. Thus, there is no lack of demographic information for that period, a fact that has greatly helped to further our knowledge and understanding of Brazil's demographic trends.

In contrast, little demographic information is available for years prior to 1970. One has to rely mainly on the results of the decennial censuses, since vital statistics are almost nonexistent (they were poorly maintained and published only infrequently during the period) and the sample survey had not yet been used as a data-gathering tool at the national level. In spite of these shortcomings, the retrospective nature of the data gathered at later points in time has made it possible to derive fairly reliable estimates for approximately the 1960-75 period. Those for earlier or later periods are usually based on weaker and less abundant data and should therefore be interpreted with caution.

Chapter 1 provides a detailed description of the sources of demographic data used in this report, while Chapters 2 and 3 describe the analytical methods applied in deriving estimates of mortality and fertility, respectively. Tables 1 and 2 summarize some of the final mortality and fertility estimates produced; Figure 1 presents the final estimated rates of natural increase.

CHILD MORTALITY

Table 1 presents the national estimates of infant and child mortality obtained for the 1940-75 period. According to these estimates, infant mortality in the country as a whole declined by about 40 percent beween 1940 and 1975, from 142 infant deaths per 1,000 live births to 86 deaths per 1,000. Child mortality appears to have undergone a somewhat greater reduction, about 50 percent. The estimated probability of dying between birth and exact age 5 was 118 deaths per 1,000 in 1970, as compared with 233 deaths per 1,000 in 1940.

Regional estimates of infant and child mortality (shown in Table 20) reveal the existence of significant regional differentials. It appears that by 1975 the southeastern part of the country (Rio de Janeiro, Sao Paulo, and the southern region bordering Uruguay) was experiencing fairly low levels of infant ($_1q_0$) and child mortality ($_5q_0$): about 67-70 and 85-90 deaths per 1,000 births, respectively. The Northeast, on the other hand, displayed infant and child mortality rates that were almost twice as high: 125 and 197 deaths per 1,000. In addition, although the direction of such differentials was maintained between 1940 and 1975, their relative magnitude increased substantially. Thus, while

TABLE 1 Summary of Estimated Mortality Measures, 1940-75: Brazil

	Infant and Child Mortality			Adult Mortality			
				Male		Female	
Year	$_1q_0$	$_5q_0$	$_{10}q_0$	e_0	e_5	e_0	e_5
1940	.142	.233	.251	44.50	53.18	47.01	55.41
1945	.136	.220	.237	46.01	54.18	48.56	56.44
1950	.130	.208	.223	47.61	55.31	50.26	57.62
1955	.124	.196	.210	49.25	56.48	52.06	58.93
1960	.119	.184	.197	50.93	57.67	53.89	60.26
1965	.109	.163	.174	53.32	59.05	56.46	61.78
1970	.098	.141	.149	55.93	60.43	59.25	63.29
1975	.086	.118	.125	58.66	61.82	62.00	64.77

in 1940 infant mortality in Rio de Janeiro and Sao Paulo was about 75 percent of that estimated for the Northeast, by 1975 their infant mortality was only 54 percent of that in the Northeast. Hence, although infant and child mortality declined in all regions, differentials between the two extremes increased.

ADULT MORTALITY

Table 1, which presents final estimates of the expectations of life at birth and at exact age 5 (e_0 and e_5), reveals that adult mortality also declined steadily between 1940 and 1975. During this period, e_5 for both sexes combined increased by an annual average of 0.26 years, although the gains achieved were slightly smaller for males than for females. The values of e_0, obtained by splicing together child and adult mortality estimates, indicate that the combined child and adult mortality decline that took place between 1940 and 1975 amounted to an increase of about 32 percent in life expectancy, or an annual average increase of about 0.41 years. Life expectancy at birth in 1940 was 44.5 and 47 years for men and women, respectively; by 1975 it had reached 58.7 years for men and 62 years for women.

FERTILITY

In contrast with the steady, long-term decline in mortality from 1940 to 1975, Brazil's fertility has recently undergone a fast and fairly widespread decline which, according to the available evidence, started only around 1965 and gained momentum during the 1970s. Part A of Table 2 shows the final set of total fertility estimates for the 1940-78 period, which is also displayed graphically in Figure 17. According to these estimates, total fertility declined from about 6 children per woman in 1960 to 4.3 children in 1978, a reduction of about 40 percent. But even more striking than its sheer magnitude is the fact that most of this decline took place after 1970.

Although no smooth and consistent time series of total fertility estimates has been derived for individual regions, Part B of Table 2 presents estimates of total fertility by region for approximate periods. These estimates reveal that, as with child mortality, sharp differentials in fertility exist between the regions. Once more, the most developed regions, Rio de Janeiro and Sao Paulo, are characterized by substantially lower fertility than that observed in the rest of the country, although the almost universal decline that has taken place recently has tended to reduce differentials between the more developed regions and the regions of traditionally high fertility, such as the South (Region 3) and Center (Region 4). In contrast, the Northeast (Region 5) remains a high fertility area; although some reduction is evident, it still lags far behind the more developed regions of the country.

POPULATION GROWTH RATES

Figure 1 shows a plot of the overall rates of natural increase (birth rate minus death rate) that are consistent with the fertility and mortality estimates derived in this report. (Table 49 presents the final estimated birth rates, death rates, and rates of natural increase for males, females, and both sexes combined.) The trend followed by these rates during the 1940-80 period takes the form of an inverted U: increasing between 1940 and 1960-64 and declining thereafter. The increasing trend observed at first is due to the steady decline in mortality already noted, while the declining

TABLE 2 Summary of Final Fertility Estimates, 1940-78: Brazil

Part A. National Fertility Estimates

	Date								
	1940.0	1942.5	1947.5	1952.5	1957.5	1962.5	1967.5	1972.5	1977.5
Total Fertility	6.25	6.25	6.20	6.10	6.00	5.90	5.60	5.00	4.30

Part B. Regional Total Fertility Estimates

	Approximate Reference Date			
Region[a]	1945-50	1955-60	1965-70	1971-76
1	4.40	4.20	4.00	3.25
2	4.70	4.50	4.10	3.31
3	6.00	6.00	5.60	4.37
4	6.50	6.50	6.40	4.79
5	7.30	7.30	7.30	6.51
6	--	5.10	5.00	4.05
7	7.00	7.00	7.00	4.72
Total	6.20	6.09	5.85	4.48[b]

[a]See Table 3 for definition of the regions.
[b]When an estimate corresponding to the rural population of Region 7 is added to the calculations, this estimate is revised to 4.60.

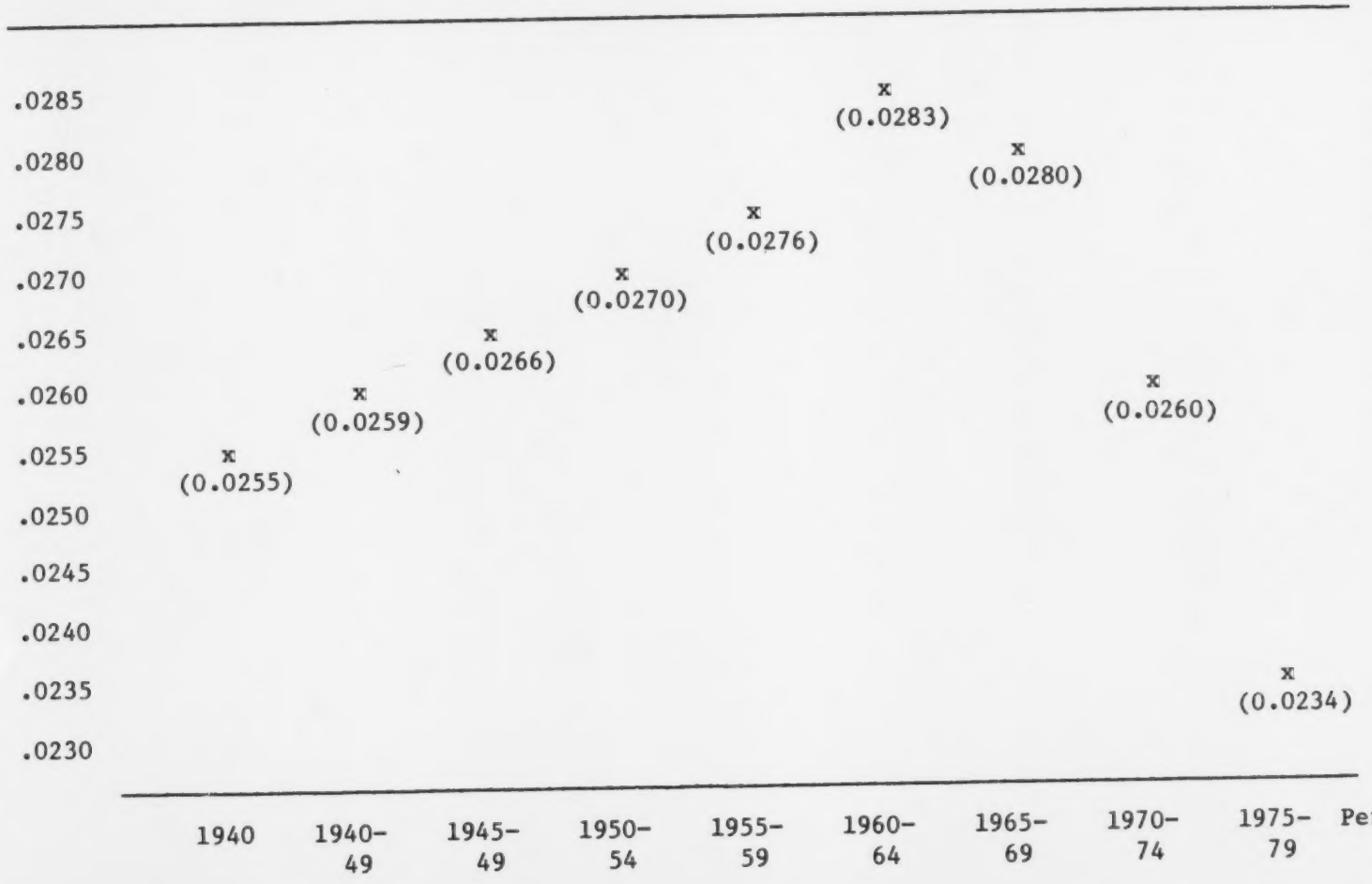


FIGURE 1 Estimated Rates of Natural Increase, 1940-80: Brazil

trend since the mid-1960s is due mainly to the declining trend in fertility. According to the estimates in Table 49, in 1940 the Brazilian population was growing at an average annual rate of 2.55 percent, which increased slowly to a peak of 2.83 percent during 1960-64, and has been declining since, reaching levels even lower than that of 1940. During 1975-79 it is quite likely that the Brazilian population grew by only 2.34 percent annually, and further reductions are expected during the 1980s.

CHAPTER 1

INTRODUCTION

BRAZIL: ITS PLACE IN THE WORLD

One-third of all Latin Americans are Portuguese-speaking and live in Brazil, the largest country in the region and the sixth most populous country in the world. With a population of approximately 119 million according to the most recent census (1980), Brazil experienced an annual growth rate of 2.46 percent during the 1970-80 decade (also according to census counts). Were this rate to continue, Brazil's population would double in some 28 years, reaching 195 million by the end of this century. Because of the social and economic implications that the future evolution of the country's population has, it is important for planners to know whether any changes are taking or have taken place in demographic trends. Of particular importance is the evolution of fertility, which seems to have decreased substantially in recent years. Although the socioeconomic characteristics and general development level of the Brazilian population lend credence to the existence of such a change, careful examination of the evidence is necessary to establish whether fertility has, in fact, declined, by how much, and since when. This report attempts to answer these questions, so as to provide planners with better bases on which to forecast the country's future needs.

The geopolitical importance of Brazil has conditioned internal attitudes and policies about population (generally pro-natalist) as well as the perception of other countries, especially those that surround it (see Melo-Moreira et al., 1978). Brazil borders all the countries of South America except Chile and Ecuador (see Figure 2). In a wider context Brazil is often seen as an emerging Third World power that is richly endowed with

FIGURE 2 Brazil and its Seven Main Regions

mineral resources and abundant agricultural land. Brazilian products are now exported competitively all over the world. Its industrial capacity is the largest in the developing world. Brazilian companies are building railroads in Africa, constructing dams in Venezuela, and extracting oil in Iraq. For all its natural and physical advantages, Brazil currently suffers from lack of domestically produced energy. Oil and coal reserves are small and impose a severe brake on what is otherwise a booming economy. On the other hand, hydroelectric potential is high and underdeveloped. Nuclear power plants are being built with the expectation that the dependency on oil imports can be offset, at least in part.

BRAZIL: ITS GEOGRAPHY

Brazil is the largest country in the South American subcontinent, comprising approximately 48 percent of its territory. Traversed by the equator in the North, most of the country lies in the southern hemisphere and its climates range from tropical to temperate. It can be divided into five major geographical regions, each having distinctive characteristics not only geographically, but also socially and economically. The seven regions used by the Brazilian Census Bureau (IBGE) in analyzing and tabulating demographic data may be matched to the five geographical regions by grouping. The definition of these "statistical" regions in terms of states and national territories is presented in Table 3, and Figure 2 shows their physical location.

Two geographical regions, the North and the Central West, make up statistical Region 7. The North comprises most of the Amazon basin and constitutes 42 percent of the country's territory. It is very sparsely populated (most of its population is concentrated in the urban areas of Manaus and Belem) and its inhabitants are a very small proportion of the total Brazilian population. The Central West, formed by the states of Goias and Mato Grosso, comprises 22 percent of the national territory and is also fairly underpopulated. Agriculture is the main economic activity in this region and the availability of unexploited land has attracted many new settlers since 1960. The Central West also contains the capital of Brazil, Brasilia, which alone constitutes statistical Region 6. Since its creation in the late 1950s, it has also been a center of attraction for new settlers.

TABLE 3 Definition of Brazil's Regions

Region	State
1	Guanabara
	Rio de Janeiro
2	Sao Paulo
3	Parana
	Santa Catarina
	Rio Grande do Sul
4	Minas Gerais
	Espiritu Santo
5	Maranhao
	Piaui
	Ceara
	Rio Grande do Norte
	Paraiba
	Pernambuco
	Alagoas
	Sergipe
	Bahia
6	Distrito Federal
7	Goias
	Mato Grosso
	Acre
	Amazonas
	Para
	Territorio de Rondonia
	Territorio de Roraima
	Territorio de Amapa

The remaining three geographic regions are located along the eastern coastline of the country. In the north, the Northeast (statistical Region 5) is composed of nine states and occupies 18 percent of Brazil's territory. About 30 percent of the Brazilian population inhabits this region, including approximately 41 percent

of the country's rural population. Agricultural activities are predominant, but the relatively high population density and the low level of land availability make it a relatively poor region, whose contribution to total national income (about 12 percent) does not match its share of the population.

Statistical regions 1, 2, and 4, located immediately south of the Northeast, constitute the Southeastern geographical region. It contains Brazil's urbanized industrial heartland and is by far the most prosperous region of the country. Although it occupies only 11 percent of the national territory, its inhabitants constitute about 41 percent of the Brazilian population. They are concentrated mainly in the country's largest urban areas: Sao Paulo, Rio de Janeiro, and Minas Gerais.

At the southernmost tip of the country, comprising the states of Parana, Santa Catarina, and Rio Grande do Sul, is the fairly prosperous South Region (statistical Region 3). Endowed with good land for agriculture and a moderate level of industrial development, its inhabitants enjoy a per capita income equal to the nation's average. Approximately 17 percent of Brazil's population lives in this region.

For reasons that will become more apparent later, the analysis of Brazilian demographic data must take into account these regions and their different characteristics. Given the size of the Brazilian population, some of the regions have as many inhabitants as some other Latin American countries. Therefore, the study of their demographic characteristics is important in its own right.

DATA SOURCES

The history of demographic data sources in Brazil is not very long, and most of them do not achieve the quality or completeness that would be desirable. True censuses (in the modern sense of the term) began to be conducted only during the latter part of the nineteenth century, and vital registration, although required by law, has not been statistically adequate during most of this century. Fortunately, these data-gathering mechanisms have been, in general, improving with time. In conjunction with several sample surveys carried out during 1970-80, they provide a fairly adequate basis for estimating recent levels of certain demographic parameters. The sections that follow present detailed descriptions of the different

data sources available, placing special emphasis on those pertaining to the 1940-79 period.

Censuses

Brazil's first official census was carried out in 1872. Unfortunately, its results were affected by both political instability and administrative inefficiency. Following this first census, there were a series of attempts to continue periodic enumerations, but a good number of them never took place. The censuses of 1880, 1910, and 1930 were cancelled. Among those that managed to get started, but were not completed, are the censuses of 1890 and 1900 (Merrick and Graham, 1979). The 1920 census, although completed, appears to have overcounted the population by about 12 percent (Mortara, 1970a).

In 1940 the Brazilian Census Bureau (IBGE) began to plan, carry out, and publish population enumerations that met international standards of design and collection. To date there are only three complete and reliable censuses of Brazil's population: 1940, 1950, and 1970. The 1960 census is not included in this category because, due to administrative problems in the early 1960s, publication of the data it gathered broke down after only a few volumes of data at the state level were completed. Not until 1977 did detailed tabulations at the national level appear. However, these were obtained from a sample of the original census returns, the only subset of the returns still available. Therefore, published volumes of the 1960 census are divided into two series: those published during the 1960 decade according to the original tabulation plan, and those published in 1977 on the basis of a sample of all returns. There are some doubts about the reliability of the latter. Tables 4 and 5 summarize the main results of the 1940-70 censuses. In addition, some preliminary results from the 1980 census are shown.

According to Table 4, the country has been experiencing a steady increase in urbanization, as measured by the proportion of the population living in urban areas. This proportion increased from some 31 percent in 1940 to about 56 percent in 1970, following an almost constant annual rate of increase between 1950 and 1970. If this rate were maintained during the 1970-80 decade, the population living in urban areas by 1980 would constitute over 70 percent of the total. It seems more likely, however, that a lower rate may have prevailed so that the

TABLE 4 Enumerated Population by Sex and Residence According to Different Censuses, 1940-80: Brazil

Census Date	Date in Years	Population Counts			Sex Ratio	Percentage	
		Male	Female	Both Sexes		Urban	Rural
1-IX-1940	1940.67	20,627,061	20,625,967	41,253,028[a]	1.0001	31.24	68.76[b]
1-VII-1950	1950.50	25,900,927	26,075,430	51,976,357[a]	0.9933	36.16	63.84[b]
1-IX-1960	1960.67	35,059,546	35,131,824	70,191,370[c]	0.9979	44.93	55.07[c]
1-IX-1970	1970.67	46,331,343	46,807,694	93,139,037[d]	0.9898	55.92	44.08[d]
1-IX-1980	1980.67	59,152,904	59,946,088	119,098,992[e]	0.9868	n.a.	n.a.

[a]From IBGE (1956).
[b]From CICRED (1975:29).
[c]From IBGE (1967-77).
[d]From IBGE (1973).
[e]From IBGE (1981).

TABLE 5 Average Annual Growth Rates by Sex for Different Intercensal Periods, 1940-80: Brazil

Intercensal Period	Intercensal Growth Rates (percent)		
	Male	Female	Both Sexes
1940-50	2.32	2.38	2.35
1950-60	2.98	2.93	2.95
1960-70	2.79	2.87	2.83
1970-80	2.44	2.47	2.46

70 percent figure may be viewed as an upper bound of the proportion of the population living in urban areas in 1980. It should be noted, perhaps, that the definition of urban areas in Brazil is mainly of an administrative nature and that it is not necessarily linked to the population size.

Table 4 shows the total population counts by sex for each of the censuses. Notice that the sex ratio of the population (proportion of males per female) has fluctuated somewhat and was considerably lower in 1970 than in 1940. Sex differentials in migration, mortality, or census coverage are all possible causes of these variations.

Table 5 shows the average annual rates of growth prevalent during the different intercensal periods as calculated from the raw census counts. In broad terms, some acceleration of the population's growth is evident between 1940 and 1970, but the pattern of this acceleration is not smooth, since there appears to have been a drastic increase in the growth rate between the 1940s and the 1950s and a slight deceleration during the 1960s.

Table 6 lists the demographic information gathered by each of the censuses from 1940 to 1970. Notice that every one of them has included questions on children ever born and children surviving. Information of this type is needed to estimate mortality levels in childhood. Brazil is one of the very few countries possessing such a long series of data on this particular topic. Unfortunately, the series is not entirely consistent, because the questions asked by the different censuses have not been the same. For instance, both the 1940 and the 1970 censuses included questions on the number of children

TABLE 6 Information Collected by Each Census, 1940-70: Brazil

Topic	Census Date			
	1-IX-1940	1-VII-1950	1-IX-1960	1-IX-1970
Age	Date of birth	Date of birth	Age at last birthday (months if less than one year)	Date of birth
	If date of birth is not known, estimated age	If date of birth is not known, estimated age	--	If date of birth is not known, estimated age
Marriage[a]	Marital status (excluding divorce)	Marital status (including divorce)	Marital status of those not living in a union	Marital status of those not living in a union
			Type of union for those living with a partner	Type of union for those living with a partner
			If living in a union, year of union	
Fertility[a]	Children born alive	Children born alive or dead	Children born alive or dead	Children born alive
	Children born dead			Children born dead
	Children surviving	Children surviving	Children surviving	Children surviving
	Age at first birth			Births during the year preceding enumeration

Migration[a]	Place of birth (state or foreign country)	Place of birth (state or foreign country)	Place of birth (state or foreign country)	Place of birth (state or foreign country)
			Length of stay in present "municipio" of residence	Length of stay in present "municipio" of residence
			Place of last residence (state or foreign country)	Lenth of stay in present state of residence
				Place of last residence (state or foreign country)
				Rural/urban status of "municipio" of last residence

[a]Asked only of a 25-percent sample in 1960 and 1970.

born dead (stillbirths), while in 1950 and 1960 the question on children ever born referred to both children born alive and children born dead. The use of this ambiguous type of question introduces a systematic bias into the data gathered and requires that they be corrected before the estimation of child mortality is attempted.

Vital Registration

Brazil has had an operating vital registration system for most of this century. Because registration of vital events is required by law, operation of the registration system falls under the mandate of the Ministry of Justice. Up until 1971 this ministry was also charged with compiling and publishing vital statistics. Nevertheless, data gathered from the vital registration system were published only intermittently, and no great effort seems to have been made to assure either their accuracy or completeness. The actual registration of vital events is carried out via privately run "cartorios," which operate on the basis of fees charged to the public for each event registered. Even today, the distribution of cartorios in the different states is not homogeneous, with a few municipalities still lacking cartorios altogether. Under these conditions it is not surprising to find that, traditionally, data produced by the vital registration system have not been used in the estimation of demographic parameters.

In 1971, the Brazilian government officially assigned the task of compiling and publishing vital statistics to the Brazilian Census Bureau (IBGE). By 1973 IBGE's staff had redesigned the forms to register vital events, in most cases supplying precoded answers to the questions posed. Use of these forms has greatly accelerated the processing of information. Furthermore, a special effort is being made to ensure that all the cartorios in operation send to IBGE the forms filled during each period. This efficient operation has already permitted the publication of vital registration data for the years 1974 and 1975, which is used in this report to estimate adult mortality.

Sample Surveys

During the 1970s a new and important source of demographic information was added to Brazil's data base: the series

of national household surveys known as PNADs (Pesquisa Nacional por Amostra de Domicilios). The PNAD surveys began in 1967 and followed the general guidelines of the Atlantida Project, whose aim was to measure employment trends. The sampling frame used to select the survey's sample was based on the 1960 census. With the results of the 1970 census a more accurate frame became available and a new PNAD series, consisting of yearly surveys, was undertaken. The type of data collected was expanded beyond employment to include other sociodemographic topics, which could be modified from year to year.

From their inception, the PNAD surveys were designed to produce regional estimates. The seven PNAD Regions shown in Table 3 and Figure 2, were defined for that purpose. Six of these regions comprise major geographic subdivisions of Brazil, while the seventh (Region 6) is the Federal District of Brasilia. Only the urban areas of Region 7 are covered by the PNAD surveys.

Not all the PNAD surveys have covered all seven regions. The 1971 PNAD took place only in the South (Regions 1, 2, and 3) and its results were never published. In 1972, the PNAD survey was carried out in five major regions (Region 7 was omitted) and in the Federal District. The 1973 PNAD was the first to cover all the PNAD regions and since then every survey has had the same coverage.

The type of demographic information gathered by each of the PNAD surveys conducted during the 1972-77 period is presented in Table 7. Every one of them has collected information that allows the indirect estimation of child mortality and fertility, however most of them do not contain questions that permit the indirect estimation of adult mortality. This is especially unfortunate since other sources of information on adult mortality are generally considered poor. Only in 1977 did the PNAD survey include a question on maternal orphanhood.

Table 7 lists no PNAD survey for the years 1974 and 1975 because instead of a normal PNAD, a rather ambitious survey known as ENDEF (Estudo Nacional da Despesa Familiar) was carried out by IBGE during that period. The purpose of that survey was to gather information about household expenditures and nutritional intake. The questionnaire used was lengthy and complicated, and the interviews themselves were quite intensive: each household was visited three times a day for an entire week. Not surprisingly, the field work for this survey took almost a year to be completed (from mid-1974 to

TABLE 7 Information Collected by Each of the PNAD Surveys: Brazil

Topic	Year of Survey			
	1972	1973	1976	1977
Age	Date of birth (day, month, and year)	Date of birth (day, month, and year)	Date of birth (month and year)	Date of birth (month and year)
	Age at last birthday	Age at last birthday	Age at last birthday	Age at last birthday
Marital Status	Marital status	Marital status	Marital status	Marital status
			Date of marriage	Whether or not in first union
Fertility	Children born alive	Children born alive	Children born dead	Children born dead
	Children born dead	Children born dead	Children dead	Children dead
	Children surviving	Children surviving	Children surviving	Children surviving
	Children born alive in the past 12 months	Children born alive in the past 12 months	Date of most recent live birth (month and year)	Date of most recent live birth (month and year)
			Identification of mother	Age at the birth of the first child
Migration	Place of birth	Place of birth	Place of birth	Place of birth
	Place of residence in September 1970 (census date)	Place of residence in September 1970 (census date)	Length of stay in present "municipio" of residence	Length of stay in present "municipio" of residence
	Length of stay in present address	Length of stay in present address	Place of previous residence	Place of previous residence
Orphanhood				Survival of mother

mid-1975) and its results are still not completely processed. The ENDEF, like any other PNAD, did include some demographic questions, such as children ever born and children surviving by sex, deaths in the household during the 12 months preceding the interview, and births to women aged 15 and over during the year preceding the interview. At present, preliminary tabulations of children ever born, children surviving, and births during the year preceding the survey for both sexes combined are available for the first six PNAD regions.

A word about the availability of the data gathered by the PNAD surveys is in order. As mentioned above, results of the 1971 survey were never published. Results for 1972 are available in mimeographed form at IBGE, and data on children ever born, children surviving, and births during the year preceding interview for the regions covered by this survey are used in this report. In 1973, the published report included only a distribution of the population by age and sex and several tables on socio-economic topics. Therefore, fertility information from the 1973 PNAD was also obtained from unpublished tabulations available at IBGE. The published volumes for 1976 contain appropriate tabulations of all the demographic variables explored and they have served as the main source of information in this report. The published volumes of the 1977 PNAD contain data on children ever born and surviving, and unpublished tabulations on maternal orphanhood and births during the year preceding interview were obtained from IBGE. Data from the ENDEF were obtained in the form of preliminary tabulations for the first six regions. Overall, the PNAD series offers a very rich source of demographic data, well suited for the application of many of the indirect estimation techniques now available.

Description of the PNAD Sample

The sample on which all the 1970-79 PNAD surveys are based is a multi-stage probability sample, with "municipios" as primary sampling units, census tracts ("setores censitarios") as secondary units, census blocks ("subsetores censitarios") as tertiary ones, and households as the final units sampled. The sample is designed so that every household in a given region has the same probability of being selected. However, the probabilities of selection change from region to region. Therefore,

although estimates for each region may be obtained directly from unexpanded data, they need to be weighted in order to properly represent the experience of the country as a whole.

In selecting the primary units that ultimately contain the households constituting the sample, the municipios were divided into two mutually exclusive sets: one containing only "municipios auto-representativos" (self-representative municipalities) and another containing all the rest. All the municipios in the first set (self-representative) necessarily provide some of the sampled households, that is, they are included as primary sampling units with probability one. All other municipios (the ones that are not self-representative) were stratified according to geographical location and two municipios were selected within each stratum. The probability of selection of each non-self-representative municipio was proportional to its population in 1970.

A municipio was classified as self-representative if it satisfied any of the three following criteria:

1. It had a population greater than or equal to the average population per municipio in the region considered according to the 1970 census count.
2. It belonged to a metropolitan area.
3. It had economic or social characteristics that made it outstanding.

At the second stage of selection, the census tracts belonging to each of the municipios selected in stage one were listed in order, beginning with those classified as urban and ending with those classified as rural. Each census tract in these lists was assigned a probability of selection proportional to the number of dwelling units it contained (according to the 1970 census). Then, using systematic sampling with a random starting point, a certain number of census tracts was selected. The exact number selected in each municipio depended, among other factors, on the average number of dwelling units per tract and on the sampling fraction that was to be attained. The urban-rural ordering used at this stage was intended to produce a stratification that enhances the theoretical representativity of the sample.

Some field work was necessary for the selection of tertiary units. The aim of this field operation (called "contagem rapida") was to count the number of dwelling units actually existing on the census tracts selected

during the previous stage. On the basis of these dwelling counts, the census tracts were divided into subsectors of approximately equal size (the same number of households). The main objective of this operation was to limit the geographical spread of the sample and to reduce traveling and other costs. In theory, a sample spread over the entire census tract would be better, because it would produce smaller variances than one concentrated in a small number of subsectors. However, the expected reduction in variance did not seem to justify the extra cost involved. The selection of subsectors was carried out in a way that assured an equal probability of selection for each household, producing therefore a self-weighting sample within each region.

The fourth stage of the selection process required once more some field work. At this stage, the households present in each of the subsectors selected were listed and lists for each subsector were used to obtain the final household sample by means of systematic sampling with a random starting point. Approximately eight households were selected in each subsector.

The sampling plan described so far was followed in selecting the samples for the 1971, 1972, and 1973 PNAD surveys. The 1974-75 ENDEF was based on a somewhat different sampling scheme, since it aimed at producing estimates for metropolitan and nonmetropolitan areas separately. Furthermore, because the field work required by ENDEF was very intensive, selected households could not be as widely spread as those selected for other surveys. Greater concentration was achieved by using pairs of neighboring households as final sampling units.

In 1976 and 1977 the sampling design described above was modified again. The third stage of the sample selection was eliminated altogether (i.e. the selection of subsectors within a census tract) and households were selected directly from all those belonging to a given census tract. To make this selection possible, a complete listing of households in the selected census tracts was performed. This procedure allowed a wider geographical spread of the selected households, hence improving the expected variances.

Expansion of the PNAD Results

The ratio method, based on the existence of independent estimates of the population, has been used to expand the

PNAD data. The 1972 and 1973 PNADs were expanded on the basis of the projected Brazilian population classified by age and sex for each of the PNAD regions. Population projections were produced by the Brazilian Center for Demographic Studies (CBED) on the basis of the 1960-70 trends. A total of 22 factors (11 for each sex) was used to expand the population of each region.

In 1976 and 1977, in order to assess the quality of the CBED projections and to gather more information about the evolution of the Brazilian population, each of these PNAD surveys was preceded by a complete listing of members of the households constituting the census tracts in the sample. The results of these listings (called "listagems") show an age distribution with a relatively narrow base (a low proportion of children aged 0-4). This phenomenon is noticeable in both the 1976 and the 1977 listagems, and it suggests either a greater undercount of young children than that achieved by the 1970 census or a decline in fertility. IBGE has accepted the "listagem" results as true and has used them to modify the set of expansion factors used previously. Hence, the 1976 and the 1977 PNADs have been expanded by factors implying a somewhat different age structure.

Some Aspects of the PNAD Field Work

The questionnaires used in all the PNAD surveys are designed to gather information about each household selected and each of its members. Interviewers are advised to obtain all this information from the head of the household or, in his or her absence, from any household member who can provide it. Therefore, in general, information on the fertility of each woman in the household, for example, is probably not provided by the women themselves, but rather by the head of household.

The field work of the earlier PNAD surveys (1972 and 1973) took place during the last quarter of each year and lasted for approximately three months. In more recent years, expansion of the field staff has allowed completion of the survey in shorter periods (approximately one month), and the survey questions on events occuring during a given period have included specific reference dates (November 28 in 1976 and October 31 in 1977). Once more, the ENDEF is an exception, having required a year to be completed (from mid-1974 to mid-1975).

ORGANIZATION OF THE REPORT

Using data from the sources described in this chapter, the succeeding chapters present estimates of levels and trends of fertility and mortality in Brazil and each of its main regions during approximately the 1950-76 period. Mortality estimates are presented in Chapter 2, followed by fertility in Chapter 3. Chapter 4 contains a summary of the main conclusions reached.

CHAPTER 2

MORTALITY

ESTIMATING CHILDHOOD MORTALITY

In most of the developing world, the traditional sources of information needed to estimate mortality rates, whether in childhood or at later ages, have been found sufficiently deficient to warrant the search for alternative data sources and estimation procedures. Mortara (1970a) was the first to use the proportions of children dead among those ever born as reported by women of different ages as indicators of mortality in childhood. Brass (1964) developed this idea further, proposing a procedure that permitted the observed proportions of children dead to be converted into life-table probabilities of dying between birth and a set of exact ages x. Thus, for example, $_2q_0$, the probability of dying between birth and exact age 2, can be estimated from the proportion of children dead among those ever borne by women aged 20-24; $_3q_0$ can be estimated from the same proportion for women aged 25-29; $_5q_0$ from the information of those aged 30-34, and $_{10}q_0$, $_{15}q_0$, and $_{20}q_0$ from that of women aged 35-39, 40-44, and 45-49, respectively. The original Brass estimation procedure was derived from data simulated by using mathematical models of the demographic processes involved. In recent years, the availability of better and somewhat more flexible models has led to the creation of new versions of the Brass procedure. The one proposed by Trussell (United Nations, 1983) has been used here to derive estimates of mortality in childhood.

Sources and Type of Data

Brazil possesses a fairly long history of statistics on children ever born and children surviving. Questions on

these topics have been included in every census since 1940 (see Table 6). Furthermore, all the PNAD surveys whose data are available have also included questions on these topics (see Table 7), so that the series of child mortality estimates obtained from census information can be expanded.

In 1940, women aged 12 and over were asked to declare the number of children born alive they had ever had, the number of those born dead, and the number who were alive at the time of the census. Analysis of the 1940 results revealed that women had declared a very high proportion of children born dead. Apparently, the instructions accompanying the questionnaires used in this census did not state explicitly that pregnancies terminating before the seventh gestational month should not be counted as stillbirths. Furthermore, in 1940 a large proportion of the urban population filled in the census questionnaires directly, without the help or presence of a census enumerator, thus increasing the possibility of respondent's error. Based on the results of the 1940 census, Mortara suggested eliminating a specific question on children born dead in subsequent censuses. In consequence, only two questions on fertility were asked during the 1950 and 1960 censuses: one on the number of children ever born, including those born dead, and another on the number surviving by the date of the census. In those two censuses, instructions accompanying the question on children ever born, whether alive or dead, clearly stated that only those pregnancies lasting more than seven months should be counted.

The 1970 census gathered fertility data only from a 25 percent sample of the population and included, as in 1940, two separate questions on children ever born: one on children born alive and another on children born dead. Stillbirths were defined again as dead children resulting from pregnancies lasting at least seven months. Table 8 shows the proportions of children born dead among those ever borne by women in five-year age groups, according to the 1940 and the 1970 censuses. Note that the 1940 figures reveal increasing proportions of children born dead with age of mother, while the ones for 1970 display a U-shaped relationship with respect to age (given the usual relationship between mother's age and child mortality, the latter are more plausible). Furthermore, while in 1940 the range of variation of the proportions dead is of approximately 3 percent, in 1970 it is of little more than one percent. Also striking is the fact

TABLE 8 Percentage of Children Born Dead Among Those Ever Born by Age of Mother, 1940 and 1970: Brazil

Age Group	Percentage of Children Born Dead	
	1940	1970
15-19	5.67	3.03
20-24	6.97	2.75
25-29	7.46	2.81
30-34	7.68	3.03
35-39	8.06	3.25
40-44	8.40	3.59
45-49	8.63	3.85

that, on average, the proportion born dead in 1940 was approximately twice that observed in 1970. The anomalies present in the 1940 data have already been discussed by Mortara (1947), Leite (1973), and Medeiros-Frias and Rodrigues (1979). All these authors agree that the 1940 figures on children born dead are an overestimate of the true incidence of stillbirths.

Since 1970 all the PNAD surveys have gathered information about children ever born, children surviving, and children born dead. However, tabulations of the latter have not been made consistently. In 1976, a year for which these data are available, the recorded proportion of children born dead is substantially higher than that recorded by the 1970 census (by about 70 percent) but still lower than that recorded in 1940. The better quality of the interviewers charged with carrying out the PNAD surveys is likely to be responsible for this differential, but its existence increases the uncertainty surrounding the estimation of the true incidence of stillbirths.

Finally, notice that according to Table 7 the questions asked in the PNAD surveys to obtain information on children ever born have not always been the same. In 1972 and 1973 a direct question on children ever born alive was posed, while from 1974 onward the number of children ever born was constructed from the reported number of children dead and the number surviving. This

change in the type of questions used may have some effect on the quality of reporting.

Correction of the Data on Children Ever Born for 1950 and 1960

Because the data on children ever born recorded by the 1950 and 1960 censuses include both children born alive and children born dead (stillbirths), they must be corrected before attempting to estimate child mortality; otherwise, the proportions of children dead, required as input by the indirect estimation procedures, would be too low and child mortality would be underestimated.

Several correction schemes have been proposed. Mortara (1970a) and Carvalho (1974) assumed that 5 percent of the children ever born declared in the 1950 and 1960 censuses were, in fact, stillbirths. This proportion was used to adjust all data on children ever born, irrespective of region or age of mother, before the child mortality estimation procedure was applied. Given that the incidence of stillbirths is not constant with respect to mother's age and that it also appears to vary according to region (it is linked to the overall mortality level of each region), this procedure does not seem very satisfactory. However, before the publication of the 1970 census results, more realistic corrections were not feasible.

Medeiros-Frias and Rodrigues (1979) used the 1970 state-level data to fit an exponential model relating the incidence of dead children among fertile women (women who had had at least one child) of a given age group to the incidence of stillbirths among the same women. Because the model was fitted separately to data of each age group, variations with respect to age were adequately reflected by it. The authors report that the percent of the variance explained by the fitted equations falls generally within the 93-96 percent range, the only exception being the equation fitted to data for the 15-19 age group which explains only 77 percent of the variance. At a second stage, Medeiros-Frias and Rodrigues fitted polynomials on mother's age to the parameters estimated for each age group in order to derive a single equation relating mother's age and incidence of children dead to the incidence of stillbirths. No measures of the overall goodness of fit of this equation are given, but they are not likely to be better than the 93-96 percent range quoted above.

An examination of the state-level data on children ever born, surviving, and born dead from the 1970 census, reveals that, for each age group of mother, a very satisfactory linear relationship prevails between the ratios CS/CEB and CS/(CEB + CBD), where CS denotes children surviving, CEB stands for children born alive (ever born), and CBD is the reported number of children born dead. Figure 3 displays plots of the points defined by these ratios. Panel 1 of the figure refers to women aged 15-19, Panel 2 to those aged 20-24. Plots for other age groups are not shown, but in all cases the linear relationship evident in the two panels of Figure 3 is equally strong. Note, however, that three deviant points appear in each panel of Figure 3. Even for the age groups not shown, the same points were found to deviate fairly markedly from the general trend of the rest. These points correspond to the states of Alagoas (AL), Goias (GI), and Paraiba (PB). Because of the distorting influence that they may exert on the estimates of the parameters relating linearly CS/CEB to CS/(CEB + CBD), they were excluded from the fitting process.

Straight lines were fitted via least-squares regression to each set of points [CS/(CEB + CBD), CS/CEB] referring to a particular age group. Table 9 shows the values of the estimated parameters and the proportion of the variance (R^2) explained in each case. Note that these proportions are substantially higher than those reported by Medeiros-Frias and Rodrigues (being about 99 percent

TABLE 9 Estimated Regression Coefficients Defining the Linear Relationship Between CS/CEB and CS/(CEB+CBD), and Measures of the Goodness of Fit of This Model: Brazil

Age Group	a	b	R^2
15-19	.1845	.8144	.9665
20-24	.1317	.8705	.9918
25-29	.1021	.9044	.9949
30-34	.1045	.9006	.9927
35-39	.0991	.9077	.9954
40-44	.0926	.9163	.9939
45-49	.0838	.9272	.9970

Note: Alagoas, Goias, and Paraiba were excluded in all cases.

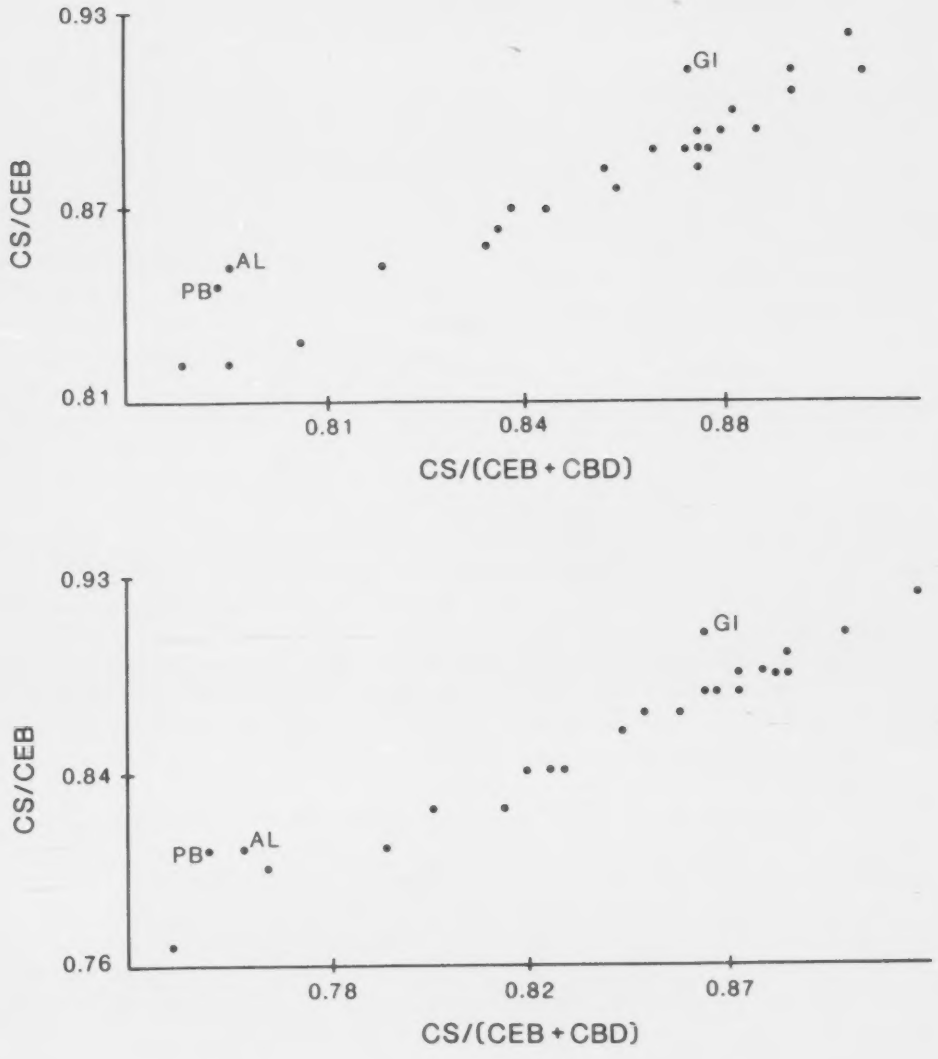


FIGURE 3 Linear Relationship Between Two Ratio Measures of Child Mortality: Children Surviving of Children Ever Born (CS/CEB) and Children Surviving of Children Born Alive and Children Born Dead (CS/CEB + CBD), 1976 Census: Brazil

in most cases). This fact indicates that the model suggested here, namely:

$$\frac{CS}{CEB} = a + b \frac{CS}{CEB + CBD} \qquad (1)$$

provides a better fit to the data than does the one suggested by Medeiros-Frias and Rodrigues. Therefore, equation (1) was used to adjust the 1950 and 1960 child mortality data.

Comparison and Assessment of the Child Mortality Estimates

Estimates of child mortality derived from the data sources corresponding to the 1950-77 period are displayed in Tables 10 to 17. Estimates are presented for Brazil as a whole and for each of its regions. Notice, however, that in 1950 Region 6 (Brasilia) was not identified as a separate entity (it was part of Region 7) and that because none of the PNAD surveys covers Region 7 as a whole, no estimates for this region are presented beyond 1970.

The estimates shown in Tables 10 through 17 are somewhat unorthodox, because they do not represent the actual estimates of child mortality yielded by the Brass-type method used, that is, the typical ${}_xq_0$ estimates associated with different age groups of mother. Instead, they are the mortality levels that these ${}_xq_0$ values imply within the "South" family of model life tables proposed by Coale and Demeny (1966).

It is usual practice to assess the consistency of the ${}_xq_0$ estimates derived from data on children ever born and surviving with reference to a given set of models. Ideally, the set used should closely represent the pattern of mortality prevalent in the population under study; however, in countries where indirect methods must be used to estimate mortality, independent evidence of reasonable quality that would permit a judicious choice of model is often unavailable. Brazil is a case in point, where the lack of reliable data makes the choice of model largely a matter of guesswork. The "South" model has been used in this analysis because it is generally accepted as a good representation of mortality patterns in Latin American countries (United Nations, 1967) and because it appears to yield the most consistent estimates of the growth rate

TABLE 10 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1950 Census Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1948.3	15.10	1948.4	15.11	1948.3	16.05	1948.4	13.73
25-29	1946.4	15.07	1946.6	15.33	1946.5	16.47	1946.7	14.29
30-34	1944.0	14.69	1944.4	14.82	1944.2	16.52	1944.4	14.23
35-39	1941.4	14.06	1941.8	14.23	1941.7	16.14	1941.9	14.02
40-44	1938.5	13.60	1938.9	13.88	1938.9	16.08	1939.1	13.76
45-49	1935.3	13.17	1935.8	13.72	1935.7	16.02	1936.0	13.69

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1948.4	9.10	--	--	1948.3	14.02	1948.4	12.58
25-29	1946.6	10.23	--	--	1946.4	14.20	1946.6	13.14
30-34	1944.4	10.54	--	--	1944.2	13.97	1944.3	13.15
35-39	1942.0	10.66	--	--	1941.6	13.20	1941.8	12.94
40-44	1939.2	10.64	--	--	1938.8	12.62	1939.0	12.80
45-49	1936.1	10.79	--	--	1935.7	12.35	1935.9	12.83

TABLE 11 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1960 Census Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1958.7	18.65	1958.7	18.55	1958.7	18.78	1958.7	16.35
25-29	1956.7	18.67	1956.7	18.59	1956.8	18.97	1956.9	16.66
30-34	1954.3	17.97	1954.2	18.06	1954.4	18.76	1954.6	16.41
35-39	1951.5	16.84	1951.5	16.83	1951.7	18.10	1952.0	15.80
40-44	1948.5	15.89	1948.5	15.93	1948.8	17.57	1949.1	15.15
45-49	1945.3	15.30	1945.3	15.43	1945.6	17.22	1945.9	14.85

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1958.6	10.28	1958.3	14.61	1958.5	17.01	1958.6	15.04
25-29	1956.9	11.10	1956.3	14.52	1956.6	17.12	1956.8	15.52
30-34	1954.8	11.26	1954.0	15.18	1954.3	16.69	1954.5	15.22
35-39	1952.3	11.43	1951.3	14.50	1951.6	16.00	1951.9	14.72
40-44	1949.6	11.36	1948.5	13.41	1948.7	15.47	1949.0	14.29
45-49	1946.4	11.57	1945.4	14.34	1945.6	14.94	1945.8	14.12

TABLE 12 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1970 Census Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1968.6	17.62	1968.6	18.18	1968.6	18.63	1968.7	16.82
25-29	1967.0	18.31	1967.0	18.61	1966.9	19.09	1967.1	17.37
30-34	1964.9	17.89	1965.0	18.47	1964.7	18.97	1965.1	17.09
35-39	1962.6	17.21	1962.6	17.83	1962.3	18.44	1962.8	16.71
40-44	1960.0	16.34	1960.0	17.22	1959.5	18.16	1960.1	16.22
45-49	1956.8	15.80	1956.8	16.48	1956.4	17.69	1957.0	15.78

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1968.6	12.76	1968.6	16.77	1968.5	17.65	1968.6	16.11
25-29	1967.0	13.06	1966.8	17.31	1966.7	17.83	1966.9	16.45
30-34	1965.0	12.73	1964.6	16.72	1964.6	17.51	1964.9	16.17
35-39	1962.6	12.43	1962.1	16.02	1962.1	17.01	1962.5	15.74
40-44	1960.0	12.12	1959.4	15.35	1959.4	16.41	1959.8	15.24
45-49	1956.8	12.05	1956.2	14.67	1956.3	15.97	1956.7	14.90

TABLE 13 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1972 PNAD Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1970.7	19.31	1970.8	20.02	1970.8	20.54	1970.9	18.97
25-29	1969.0	20.53	1969.1	20.73	1969.2	20.54	1969.4	19.34
30-34	1967.0	20.12	1967.1	20.42	1967.1	19.53	1967.5	18.64
35-39	1964.7	19.13	1964.8	19.19	1964.7	19.02	1965.3	17.51
40-44	1962.1	18.45	1962.2	18.93	1962.1	18.79	1962.8	17.32
45-49	1959.0	17.46	1959.1	17.81	1958.9	18.26	1959.6	16.51

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1970.7	12.30	1970.7	19.06	--	--	1970.8	16.58
25-29	1969.1	12.70	1969.1	19.08	--	--	1969.2	17.06
30-34	1967.2	12.03	1967.2	18.51	--	--	1967.2	16.38
35-39	1965.0	12.00	1965.0	17.53	--	--	1964.9	16.04
40-44	1962.4	11.37	1962.5	16.69	--	--	1962.3	15.50
45-49	1959.3	11.24	1959.4	16.40	--	--	1959.2	14.90

TABLE 14 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1973 PNAD Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1971.7	20.43	1971.7	20.44	1971.9	19.83	1972.0	19.06
25-29	1970.1	19.90	1970.2	20.84	1970.1	21.07	1970.3	19.27
30-34	1968.2	19.84	1968.3	20.40	1967.8	20.20	1968.3	18.47
35-39	1965.9	19.32	1966.1	19.69	1965.2	20.06	1965.9	16.80
40-44	1963.4	17.64	1963.6	18.95	1962.3	19.42	1963.1	17.65
45-49	1960.2	17.58	1960.5	18.19	1959.1	18.82	1960.0	16.55

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1971.8	12.26	1971.8	18.98	--	--	1971.8	16.76
25-29	1970.1	13.11	1970.2	19.41	--	--	1970.1	17.43
30-34	1968.0	11.86	1968.2	18.76	--	--	1968.0	16.54
35-39	1965.6	11.72	1965.9	18.35	--	--	1965.7	16.08
40-44	1963.0	11.32	1963.4	17.13	--	--	1963.0	15.70
45-49	1959.8	10.90	1960.2	16.01	--	--	1959.8	15.04

TABLE 15 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1974-75 ENDEF Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1972.8	18.78	1972.9	20.18	1973.0	20.39	1973.1	18.13
25-29	1971.2	18.86	1971.3	19.31	1971.4	19.70	1971.6	17.24
30-34	1969.2	18.47	1969.5	18.27	1969.4	19.29	1969.7	18.19
35-39	1966.9	18.25	1967.3	17.97	1967.2	18.78	1967.6	16.86
40-44	1964.3	17.62	1964.8	17.05	1964.6	17.40	1965.0	15.59
45-49	1961.2	16.65	1961.7	16.54	1961.4	17.40	1961.9	15.56

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1972.8	12.65	1973.0	19.59	--	--	1972.9	16.84
25-29	1971.3	11.63	1971.4	18.28	--	--	1971.4	15.92
30-34	1969.6	11.66	1969.3	18.37	--	--	1969.5	15.82
35-39	1971.5	11.31	1967.0	16.76	--	--	1967.4	15.25
40-44	1965.1	10.96	1964.4	16.71	--	--	1964.9	14.65
45-49	1962.0	11.38	1961.2	15.49	--	--	1961.7	14.53

TABLE 16 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1976 PNAD Data: Brazil

Age Group of Mother	Region 1		Region 2		Region 3		Region 4	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1974.6	21.25	1974.6	20.18	1974.8	18.93	1974.8	19.20
25-29	1973.0	20.72	1973.0	20.73	1973.1	20.97	1973.3	19.57
30-34	1971.2	20.91	1971.0	20.23	1971.0	20.42	1971.4	19.67
35-39	1969.1	19.70	1968.8	19.81	1968.6	19.61	1969.2	19.10
40-44	1966.6	19.02	1966.2	19.90	1965.9	19.88	1966.6	17.53
45-49	1963.5	18.58	1963.1	18.58	1962.8	19.46	1963.5	17.89

Age Group of Mother	Region 5		Region 6		Region 7		Whole Country	
	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1974.7	13.46	1974.8	20.90	--	--	1974.7	17.30
25-29	1973.0	14.95	1973.0	20.58	--	--	1973.0	18.42
30-34	1971.0	14.46	1970.8	19.93	--	--	1971.0	18.01
35-39	1968.6	13.13	1968.3	18.99	--	--	1968.8	16.97
40-44	1966.0	12.57	1965.5	18.68	--	--	1966.2	16.61
45-49	1962.8	12.35	1962.3	17.72	--	--	1963.1	16.22

TABLE 17 Reference Dates and South Mortality Levels Consistent with the Estimates of Child Mortality Obtained from the 1977 PNAD Data: Brazil

	Region 1		Region 2		Region 3		Region 4	
Age Group of Mother	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1975.7	20.59	1975.6	20.09	1975.8	19.15	1975.9	19.17
25-29	1974.8	21.55	1973.9	20.49	1973.9	21.02	1974.2	20.02
30-34	1971.9	19.79	1971.8	20.73	1971.7	20.31	1972.1	18.54
35-39	1969.6	20.05	1969.4	19.82	1969.1	19.58	1969.7	18.88
40-44	1966.9	19.27	1966.8	18.76	1966.2	19.53	1966.9	18.28
45-49	1963.8	18.40	1963.6	18.62	1963.1	19.03	1963.7	17.65

	Region 5		Region 6		Region 7		Whole Country	
Age Group of Mother	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level	Reference Date	South Mortality Level
20-24	1975.6	15.02	1975.6	21.27	--	--	1975.7	18.01
25-29	1974.0	15.14	1974.0	19.97	--	--	1974.0	18.55
30-34	1972.0	14.32	1971.9	18.90	--	--	1971.9	17.78
35-39	1969.7	13.55	1969.6	19.18	--	--	1969.5	17.23
40-44	1967.2	13.01	1967.0	18.48	--	--	1966.9	16.74
45-49	1964.0	12.42	1963.9	17.91	--	--	1963.7	16.10

for the country as a whole when methods based on model stable populations are used (United Nations, 1983). However, even if "South" could be proven to be the best model for the Brazilian population as a whole, it does not necessarily follow that it is the best model for each of the country's regions. Again, lack of reliable data precludes the exploration of regional variations in the pattern of child mortality, and in order to avoid the introduction of spurious differentials, the "South" model has been used in analyzing both national and regional data.

A rapid examination of Tables 10 through 17 reveals that child mortality has been declining steadily during the past 40 years, at both the regional and national level. However, this global decline in mortality has not been accompanied by a comparable reduction of the regional differentials revealed by the 1950 data. According to Table 10, a differential of roughly three and one-half mortality levels was apparent in 1938-44 between the fairly developed Regions 1 and 2 (Rio de Janeiro and Sao Paulo) and the underdeveloped Region 5 (the Northeast). According to the 1977 data (Table 17), this differential had increased to about six levels by 1969-72, with the Northeast exhibiting very high child mortality. In other words, the gains in the country's expectation of life achieved by the reduction of infant and child mortality between the early 1940s and the early 1970s have not been equally distributed among Brazil's various regions.

Also noteworthy is the fact that the most developed regions of Brazil (Regions 1, 2, and 3) exhibit model mortality levels that are consistently higher than those referring to the country as a whole (that is, actual child mortality in Rio de Janeiro, Sao Paulo, and the South is consistently lower than that at the national level). This outcome depends on the regional distribution of Brazil's population, which determines the weights that the regional estimates displayed in Tables 10 through 17 have on the national total. Table 18 presents the regional distribution of the population at two points in time: 1960 and 1970. Although some changes are noticeable between these two dates, the general picture emerging is similar in both instances: about 45 percent of Brazil's population inhabits Regions 1, 2, and 3, the most developed areas of the country, while about 30 percent inhabits the fairly backward Region 5 (the Northeast). Therefore, most of the positive influence

TABLE 18 Regional Distribution of the Population, 1960 and 1970: Brazil

Region	Enumerated Population		Percent of the Total	
	1960	1970	1960	1970
1	6,649,646	8,994,802	9.47	9.66
2	12,823,806	17,771,936	18.27	19.08
3	11,781,632	16,496,493	16.79	17.71
4	11,250,465	13,086,748	16.03	14.05
5	22,156,890	28,111,926	31.57	30.18
6	139,796	537,492	0.20	0.58
7	5,389,135	8,139,627	7.68	8.74
Total	70,191,370	93,139,024	100.01	100.00

exerted by the low child mortality observed in the first three regions is cancelled out by the negative one exerted by the less-developed Northeast. Hence, Brazil's overall levels fall between these two extremes.

The child mortality estimates presented in Tables 10 through 17 are accompanied by reference dates estimated by using Trussell's method (United Nations, 1983). According to these dates, the estimates derived from different sources (especially those corresponding to the PNAD surveys) often refer to overlapping time periods. Their consistency can therefore be assessed by making comparisons within regions.

Figures 4 through 11 display estimates of $_2q_0$, the probability of dying between birth and exact age 2, for the period 1935-75 for Brazil and each of its regions. The $_2q_0$ estimates obtained from any single source have been linked together. Once more, the $_xq_0$ estimates yielded by the estimation method used (Trussell's version of the one originally proposed by Brass and described in United Nations, 1983) have been translated into the corresponding $_2q_0$ estimates via the "South" model. Therefore, for any given data source, the most recent $_2q_0$ estimate is derived indirectly from data referring to women aged 20-24 at the time of interview, while those referring to earlier periods are derived from data corresponding to progressively older women.

In assessing the reliability of the estimates displayed in Figures 4 through 11, the possibility of two types of

biases that frequently affect indirect child mortality estimates must be kept in mind. First, it is common for older women (40 and over) to underreport their number of children dead, a phenomenon that would bias downward the $_2q_0$ estimates referring to the earliest periods covered by any given data source. Second, the estimation method used assumes that child mortality levels are independent of age of mother at the time of the birth. However, in actual populations, higher-than-average child mortality is often observed among the offspring of younger women (15-24). Hence, data referring to women aged 20-24 often yield overestimates of child mortality.

Most of the estimates for Brazil as a whole (shown in Figure 4) indicate that the second type of bias is in operation, since almost universally their most recent points indicate a reversal of the downward trend implied by the rest. The only exception is the curve associated with the 1974 ENDEF Survey, which also happens to fall out of line with those derived from the other PNADs. With the exception of the ENDEF estimates and the ones associated with age groups 20-24, those corresponding to the 1960-75 period and derived from the 1970 census and from the PNADs are fairly consistent. The 1960-67 estimates derived from the 1972 and 1973 PNAD surveys suggest that those obtained from the 1970 census may be somewhat low, but the difference is quite small. It is also likely that the 1960-67 estimates derived from the reports of older women from the 1976 and 1977 PNADs may be slightly low.

Of greater importance is the discrepancy between the estimates derived from the 1950 and 1970 censuses and those obtained from the 1960 census. It is clear that, for Brazil as a whole, the latter fall below the general trend suggested by the former. A rapid examination of Figures 5 through 11 reveals that the same problem is evident at the regional level. This problem may arise either because mortality in childhood did not decline consistently or according to a roughly linear trend during the period being considered or because the 1960 census data on children ever born and surviving are deficient. Although the first possibility cannot be entirely discarded, the second one seems more likely and is, to a certain extent, validated by the possible problems in processing the 1960 census. Consider, for example, Figures 5 and 6 showing the series of $_2q_0$ estimates for Regions 1 and 2, respectively. The estimates derived from the 1960 data are not only lower than

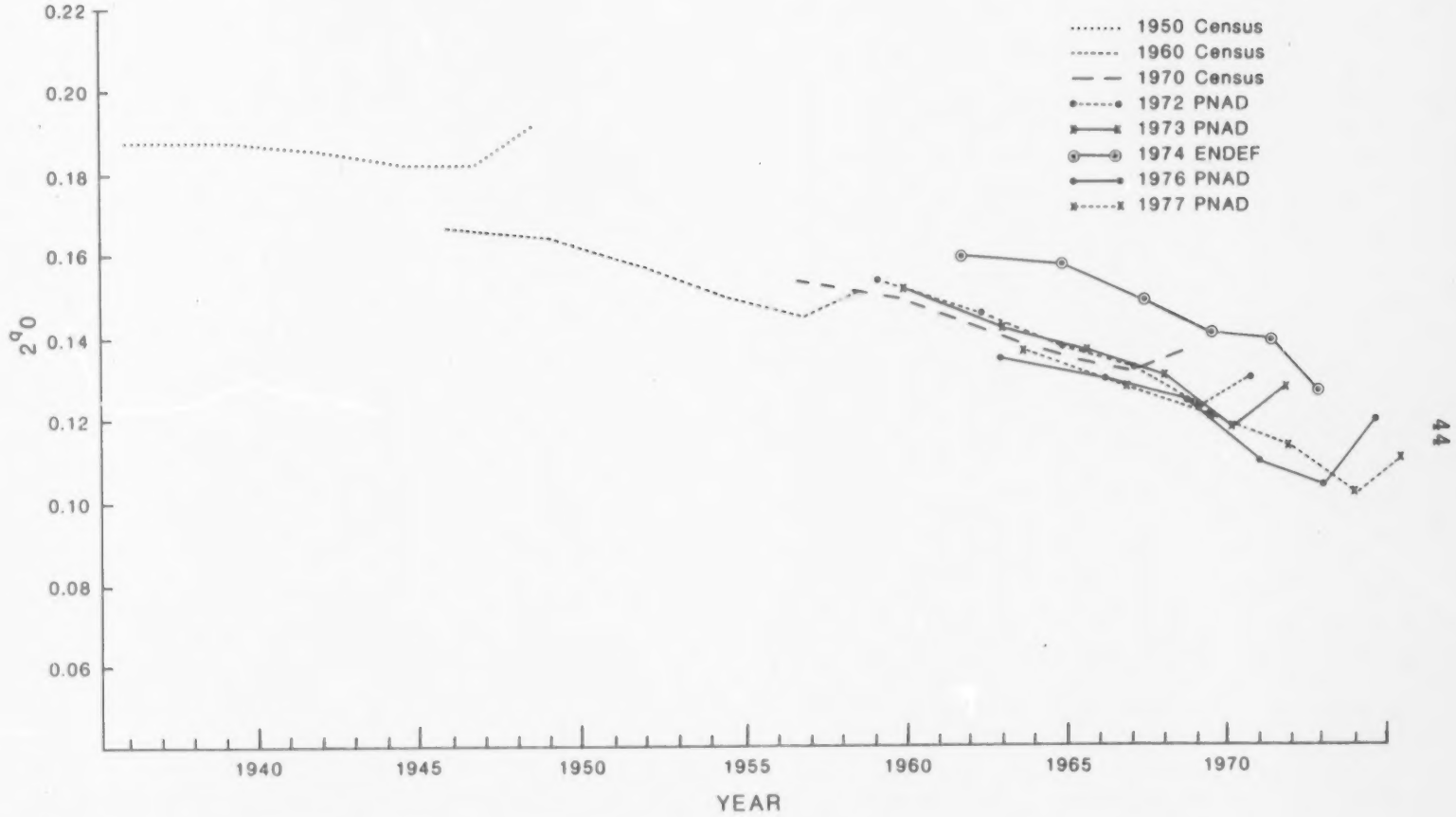


FIGURE 4 Estimates of $_2q_0$ for the Country as a Whole

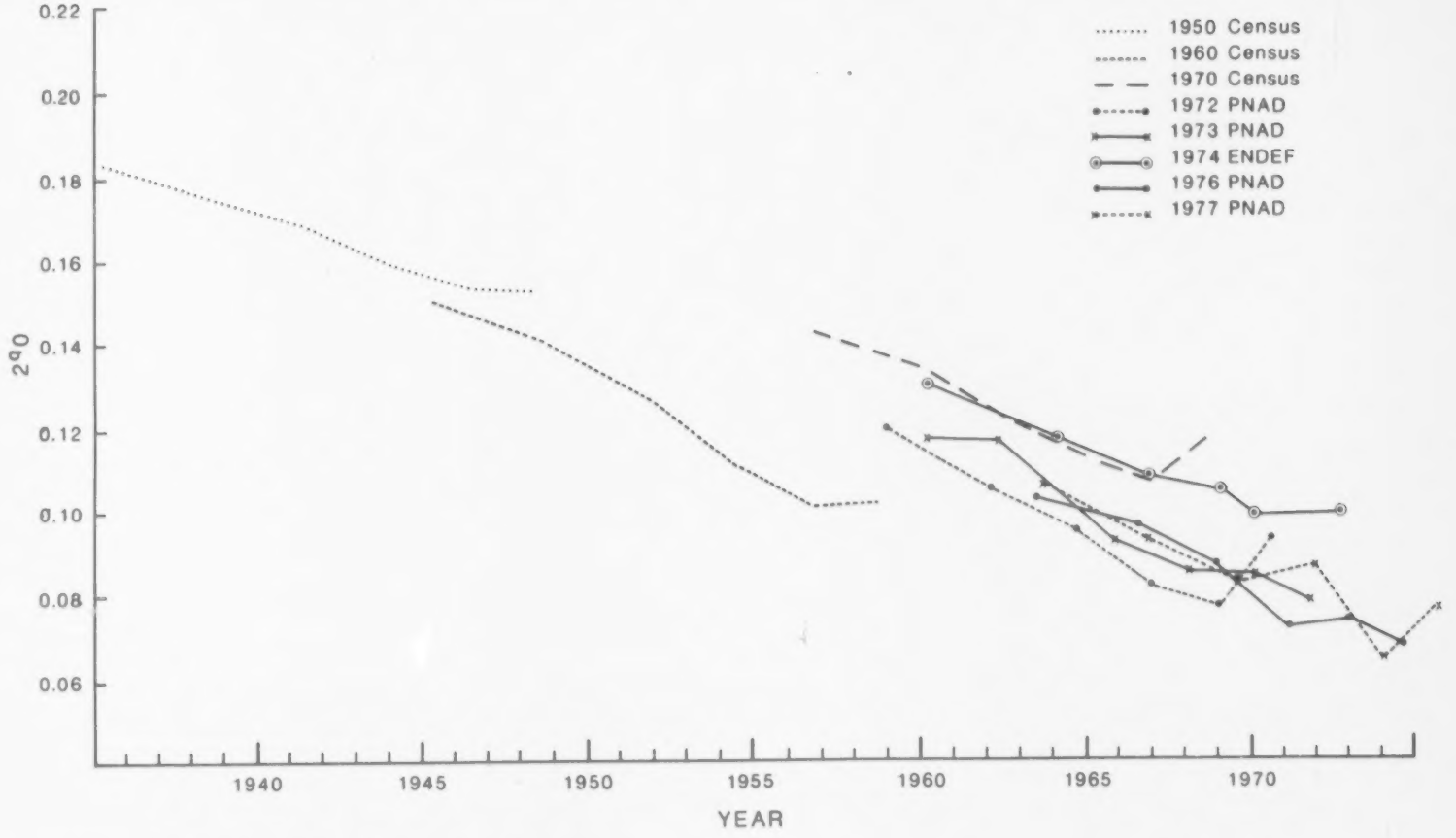


FIGURE 5 Estimates of $_2q_0$ for Region 1

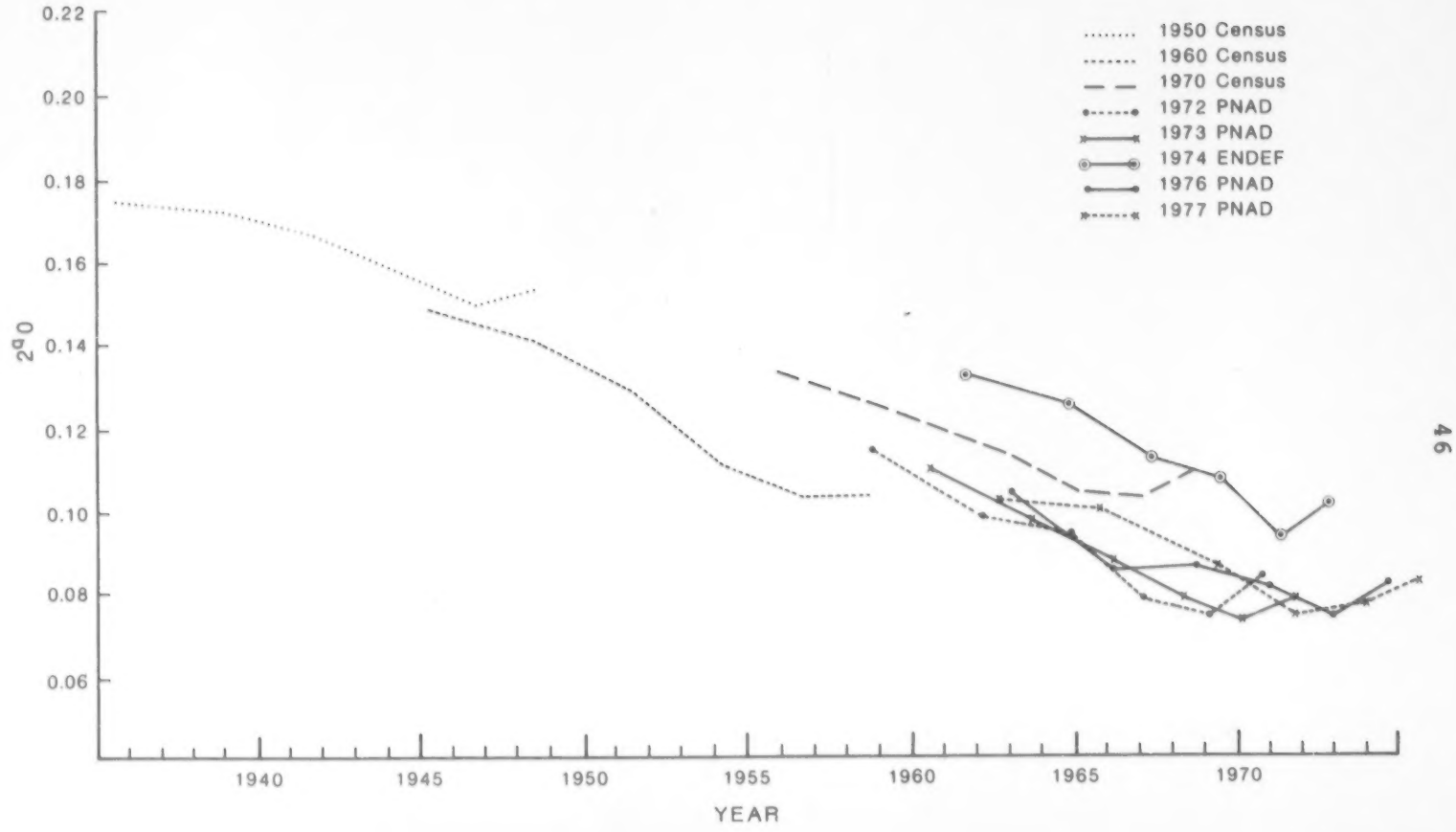


FIGURE 6 Estimates of $_2q_0$ for Region 2

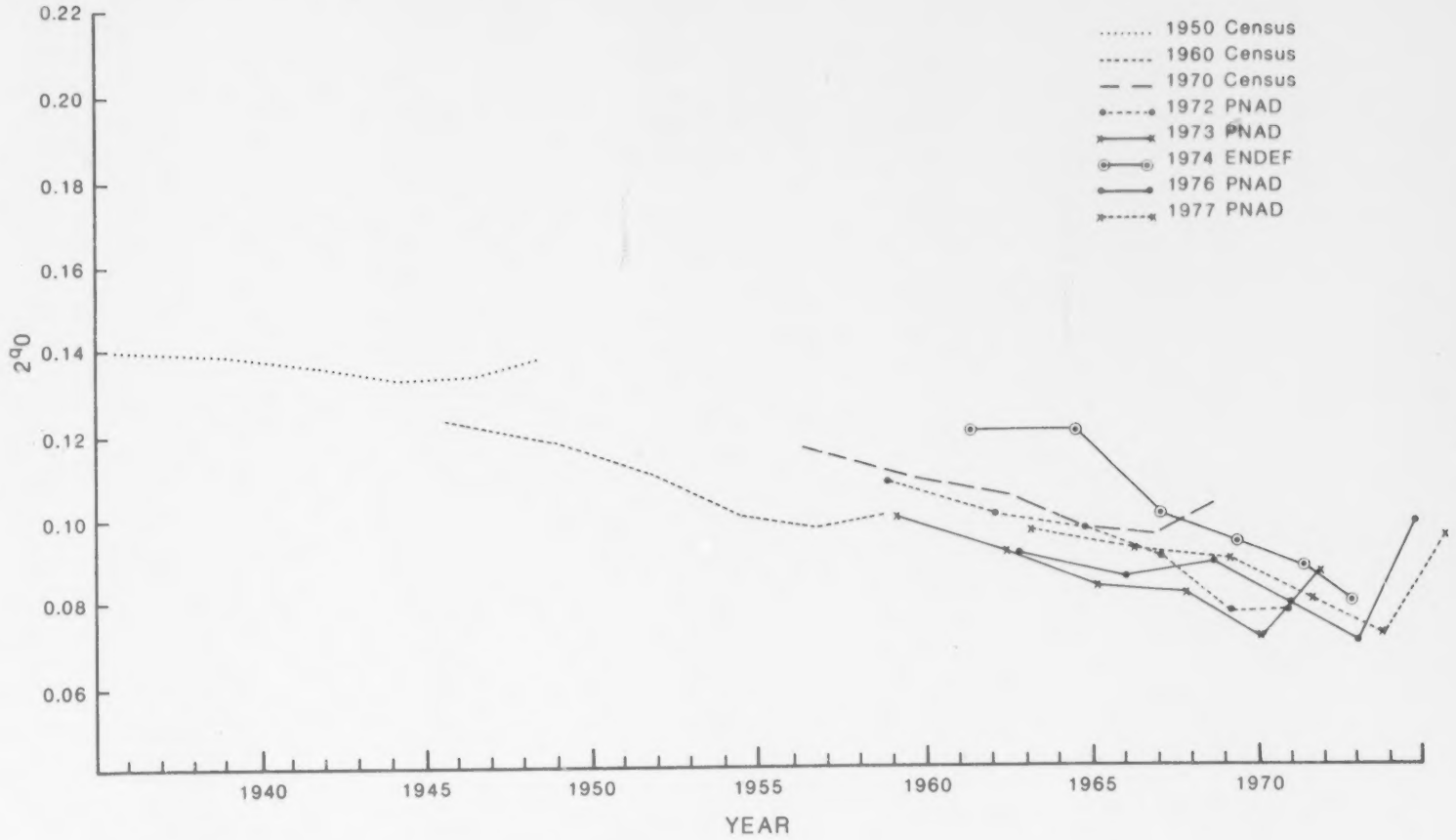


FIGURE 7 Estimates of $_2q_0$ for Region 3

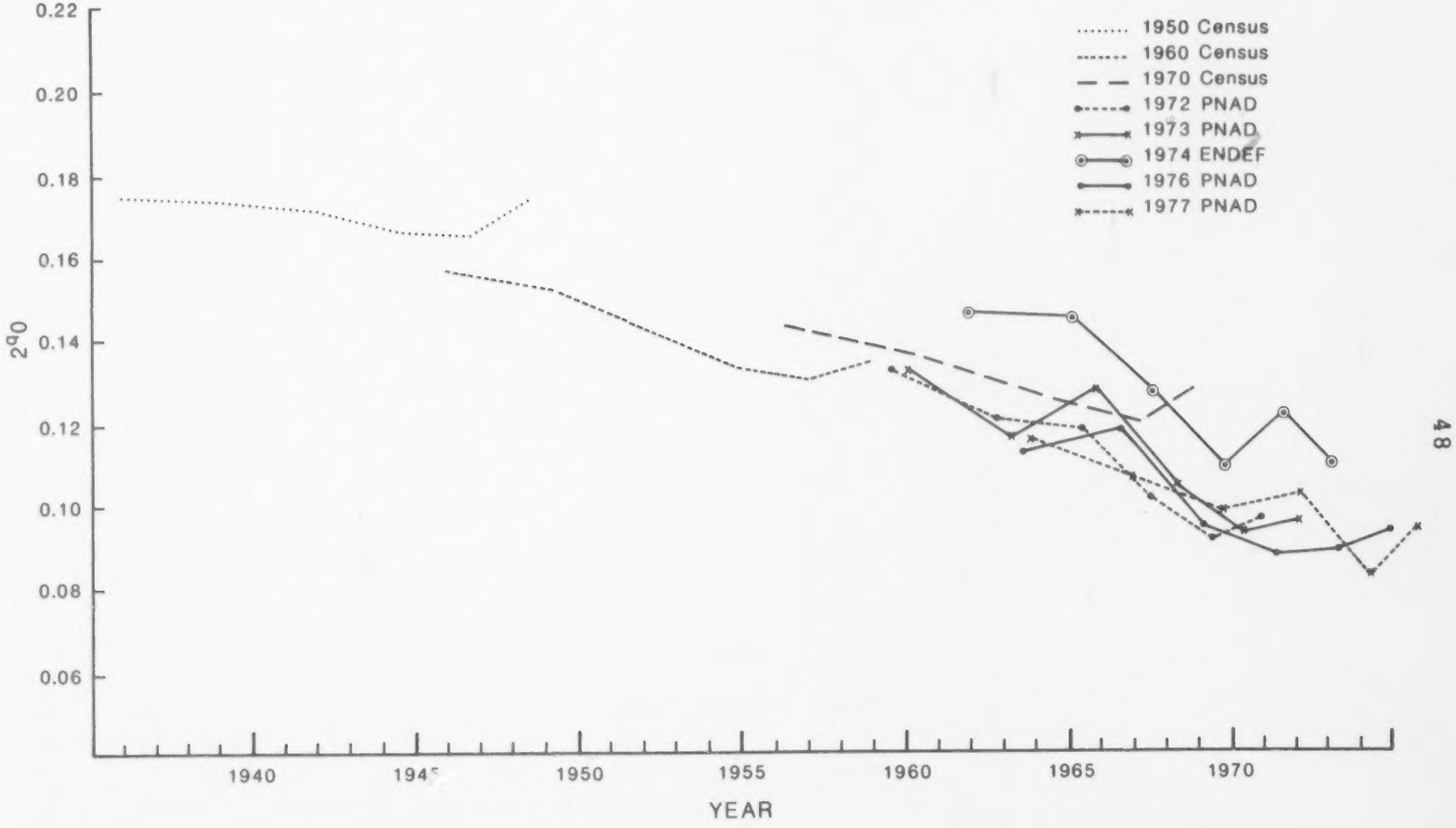


FIGURE 8 Estimates of $_2q_0$ for Region 4

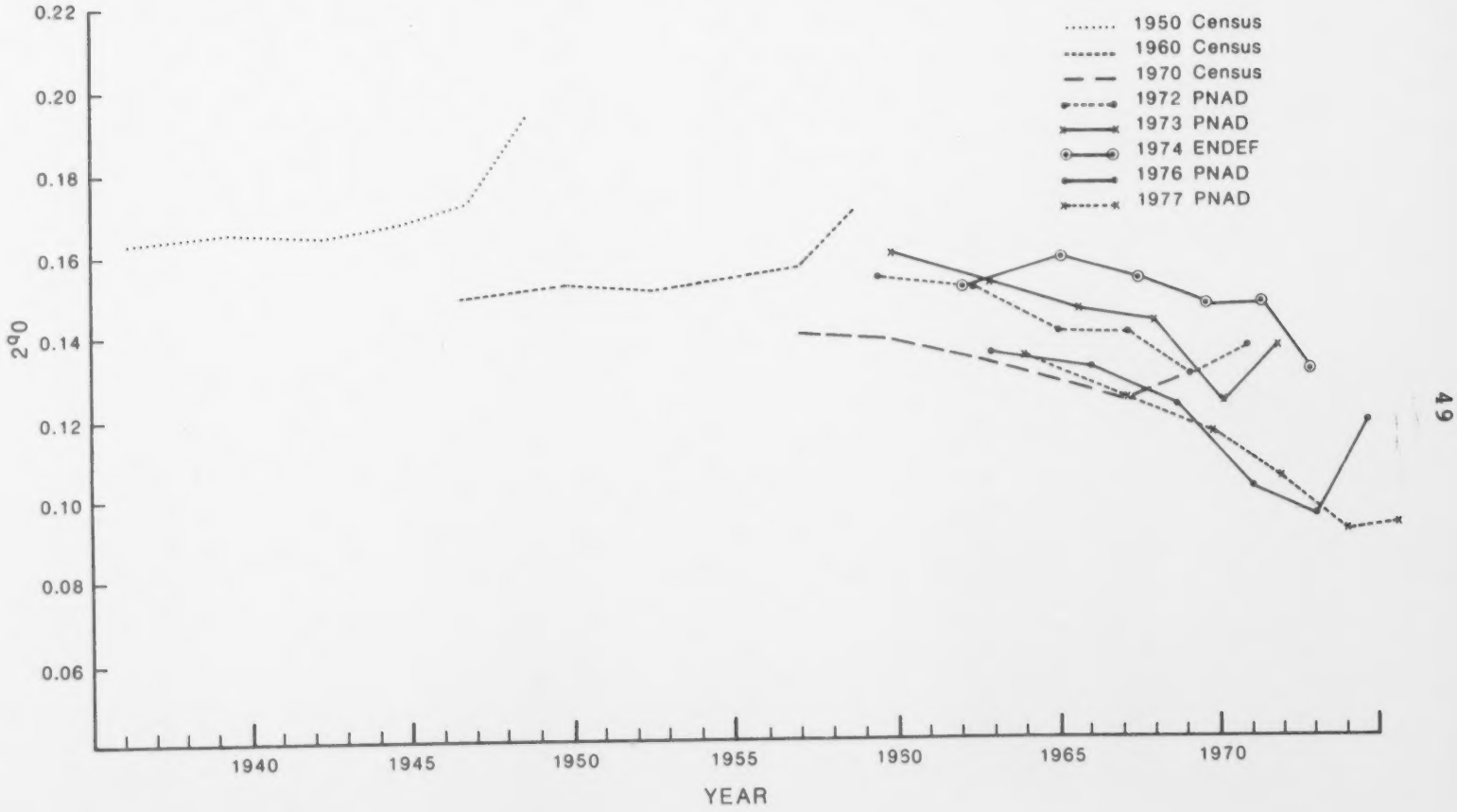


FIGURE 9 Estimates of $_2q_0$ for Region 5

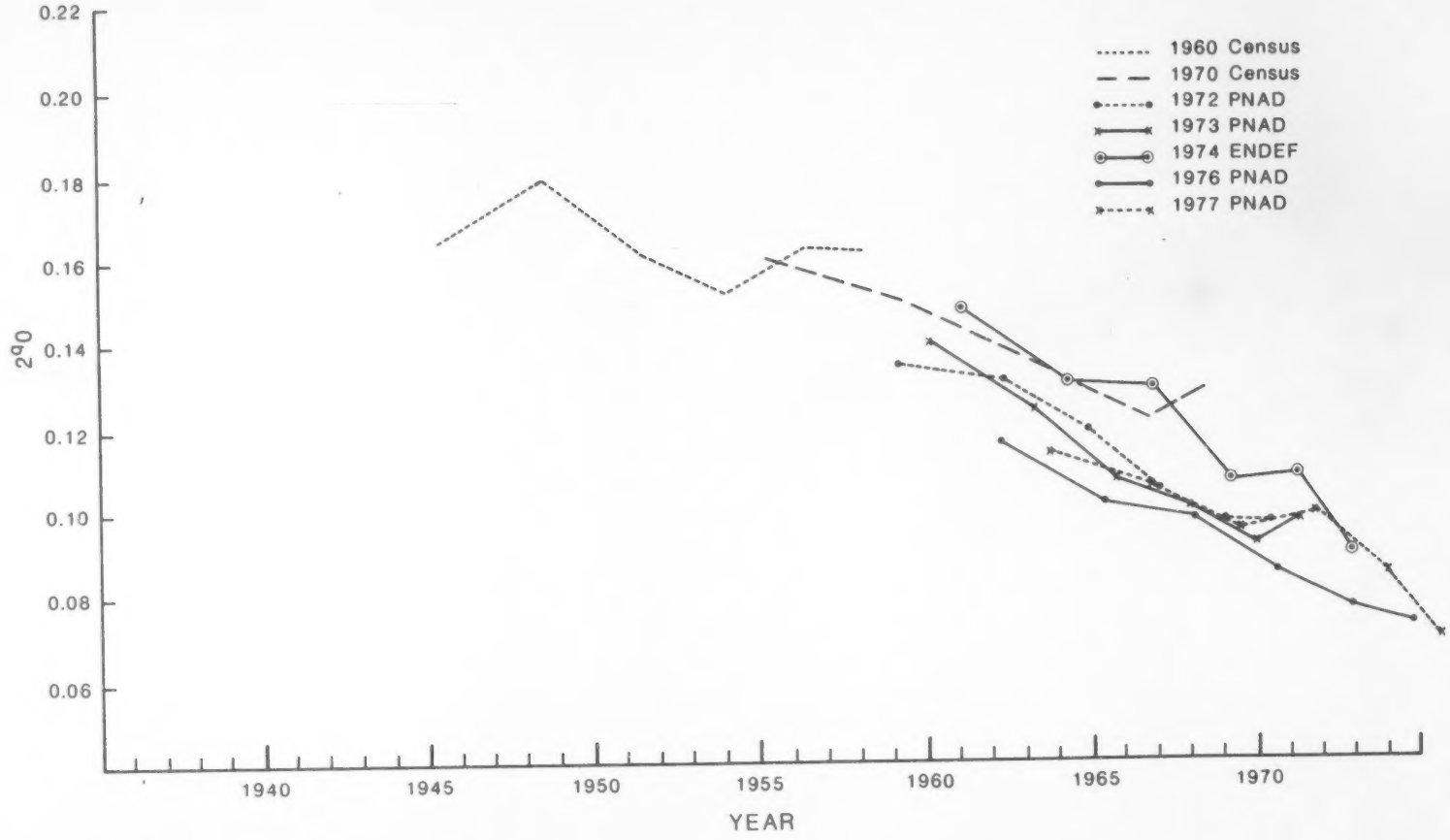


FIGURE 10 Estimates of $_2q_0$ for Region 6

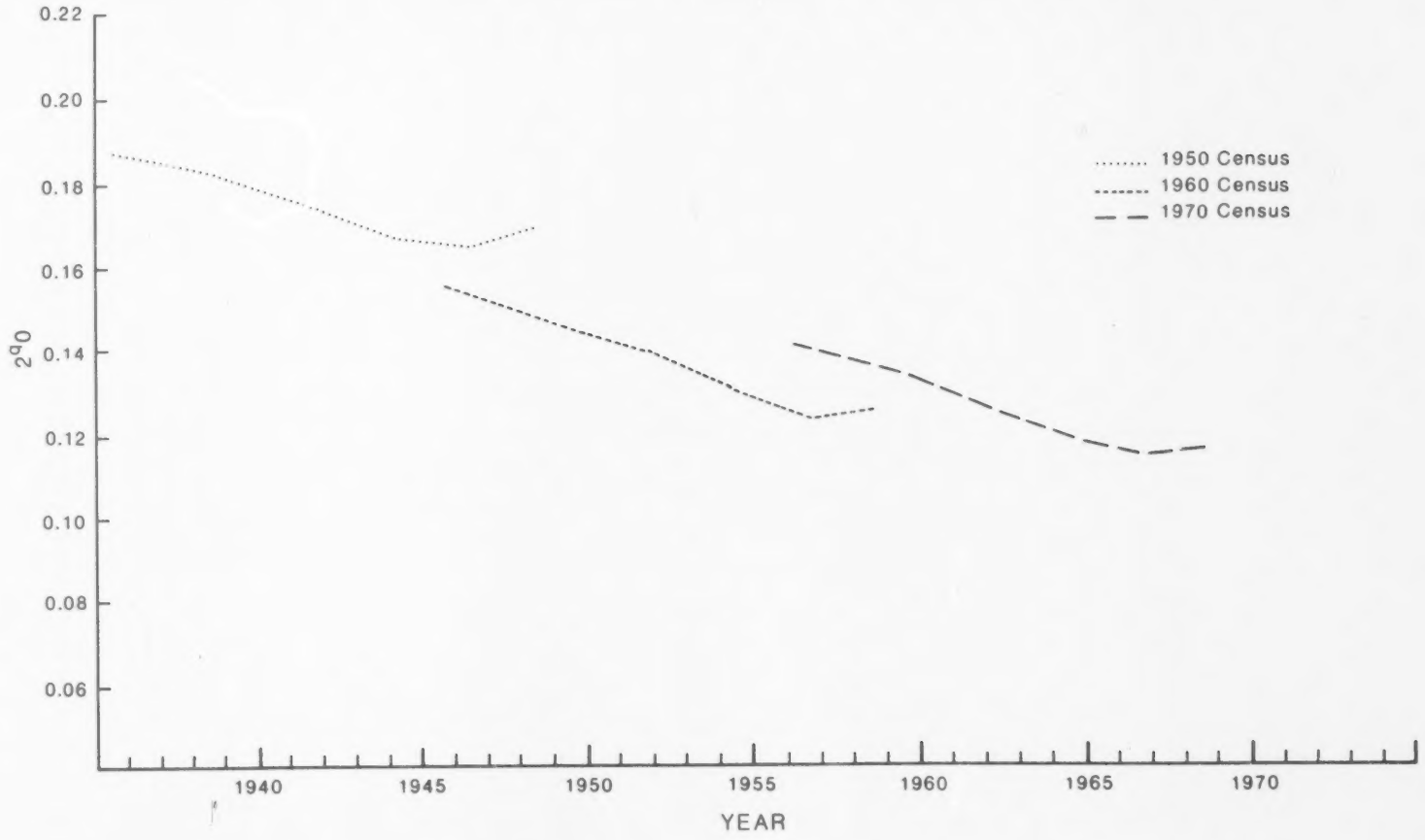


FIGURE 11 Estimates of $_2q_0$ for Region 7

the trend-line implied by those associated with the 1950 and 1970 censuses, they also refer, at the two extremes, to dates for which estimates obtained from other sources are available. For the earliest dates, estimates associated with the younger women in 1950 are directly comparable with those associated with older women in 1960. As mentioned above, the latter are likely to be too low, while the former, if associated with age groups 20-24, may be too high. Figures 5 and 6 show that the estimates based on the 1960 data fall below those based on the 1950 data, and that this relationship holds even when the 1950-based estimate considered is that derived from the information of women aged 25-29, which is usually not subject to an upward bias. For more recent dates, the 1960-based estimates derived from data referring to younger respondents may be compared with the 1970-based estimates corresponding to older women. This comparison seems to support the fact that the 1960-based estimates are deficient, since in spite of the upward bias they are likely to exhibit, they fall below the 1970-based estimates which are likely to be biased downward. The same type of observations can be made about the 1960-based estimates for most of the other regions and for Brazil as a whole, suggesting that, barring gross biases in the estimated reference dates, child mortality estimates derived from the 1960 census data should not be accepted.

Considering now the $_2q_0$ estimates at the regional level for the 1960-75 period (Figures 5 through 11), it is noticeable that the ones obtained from the 1974 ENDEF are generally higher than those obtained from the PNAD surveys. For most regions it is also true that the ENDEF estimates are higher than those derived from the 1970 census data, the two notable exceptions being Region 1 and, to a lesser extent, Region 6. The almost perfect coincidence between the ENDEF-based estimates for Region 1 (see Figure 5) and those obtained from the 1970 census suggests that either both data sources are equally flawed or that, if valid for Region 1, they cannot be rejected overall. It is not possible to establish beyond all reasonable doubt that the ENDEF overestimates mortality, but the general consistency observed between the estimates derived from the various PNAD surveys and, in most instances, between these and the ones obtained from the 1970 census does not warrant their rejection in favor of those derived from the ENDEF.

A Final Set of Child Mortality Estimates

A careful examination of the trends and relations exhibited by the different sets of estimates presented in Figures 4 to 11 led to the selection of a set of key levels representing child mortality at the regional and at the national level. Table 19 presents the selected levels in conjunction with their reference dates. They were selected so that the trend lines they define represent a reasonable compromise among those suggested by the detailed estimates derived from the different data sources available. In every instance, estimates derived from the 1960 census data were ignored, and in general the levels selected for more recent periods fall somewhere in between those suggested by the ENDEF and those derived from the other PNADs. In this sense, the estimates for more recent periods may be somewhat conservative, since they do not reflect the lowest possible values suggested by the PNADs.

Once a set of key levels was selected for each region and for the country as a whole, linear interpolation was used to derive yearly estimates referring to January 1. Table 20 shows a summary of these estimates for the 1940-75 period at five-year intervals. For Region 6 (the Federal District of Brasilia) estimates are presented only for the 1960-75 period, since this region was not defined prior to 1960. For Region 7, the estimates referring to 1975, and even those referring to 1970, were obtained by extrapolating linearly the trend implied by the estimates derived from the 1970 census data. The data available for the urban areas of Region 7 from the two most recent PNADs (not shown) suggest that child mortality has declined steadily since 1970 and that the extrapolated level for 1975 (19.09) is acceptable.

It should be pointed out that most of the national estimates for the 1960-75 period are based on data that either exclude the whole of Region 7 (the 1972 and 1973 PNADs, and the 1974 ENDEF) or only its rural areas (the 1976 and 1977 PNADs). To the extent to which the population of the excluded areas is subject to mortality levels that differ from those of the rest of the population, the "whole country" estimates that do not incorporate their data will be biased. However, according to the 1970 census, the magnitude of this bias will be small because the population of Region 7 constitutes only about 10 percent of the country's total, and in terms of mortality levels of the Coale-Demeny tables its

TABLE 19 Set of Key Child Mortality Levels: Brazil

Region 1		Region 2		Region 3		Region 4	
Year	South Mortality Level	Year	South Mortality Level	Year	South Mortality Level	Year	South Mortality Level
1941.0	14.06	1941.8	14.23	1941.7	16.14	1941.9	14.02
1963.4	17.64	1962.6	17.83	1962.3	18.44	1960.1	16.22
1971.9	19.79	1974.6	20.18	1969.1	19.58	1967.1	17.37
						1972.1	18.54

Region 5		Region 6		Region 7		Whole Country	
Year	South Mortality Level	Year	South Mortality Level	Year	South Mortality Level	Year	South Mortality Level
1946.6	10.23	1956.2	14.67	1944.2	13.97	1944.3	13.12
1963.0	11.32	1965.0	17.53	1959.4	16.41	1959.2	14.90
1970.1	13.11	1974.0	19.97	1964.6	17.51	1964.9	16.04
				1966.7	17.83	1971.9	17.78

sign will be negative, since Region 7 exhibits mortality levels higher than those of the whole country (i.e., lower child mortality). Hence, if anything, the recent mortality estimates for Brazil as a whole derived from the PNAD data may slightly overestimate child mortality.

According to the final estimates of child mortality presented in Table 20, Brazil has experienced a steady decline in child mortality since 1940. This decline was somewhat slower prior to 1960 than since; in terms of infant mortality ($_1q_0$), the decline was about 16 percent between 1940 and 1960 and about 28 percent between 1960 and 1975. In total, infant mortality in Brazil declined by about 40 percent during the 1940-75 period. However, as stated earlier, this decline has not been equally distributed among all of Brazil's regions. Thus, while Regions 1 and 2 (Rio de Janeiro and Sao Paulo) exhibited an average decline of some 47 percent, Region 5 (the Northeast) saw its child mortality levels reduced by only 27 percent. The other large regions (3, 4, and 7) experienced declines comparable to those of the country as a whole.

It is interesting to note that infant mortality in Region 5 decreased by about the same amount during the first 15-year period considered (1940-65) as during the last 10-year period (1965-75). Therefore, some acceleration of the mortality decline is evident even in the most backward region of Brazil, an encouraging fact. In spite of these gains, however, much remains to be done. Out of every 100 births, some 12 children in the Northeastern Region still expect to die before age 1. The comparable figure for Sao Paulo and Rio is 7 per 100, still fairly high. Hence the corroboration of further reductions suggested by the most recent data will be welcome. For example, although initial estimation of mortality with 1980 census data gives results comparable to those estimated here, detailed analysis of those data is required to establish firm estimates.

ESTIMATING ADULT MORTALITY

In contrast with the wide availability of data for estimating child mortality in Brazil, the sparsity of data useful for estimating mortality in adult ages is striking. Direct information on the occurrence of deaths by age is available only for the 1960-64 period and for 1974-75. Information on maternal orphanhood is available

TABLE 20 Final Child Mortality Estimates, 1940-75: Brazil

Year	Region 1 South Level	1q0	5q0	10q0	Region 2 South Level	1q0	5q0	10q0
1940	13.90	.129	.205	.221	13.92	.129	.205	.220
1945	14.70	.121	.190	.203	14.78	.121	.188	.201
1950	15.50	.114	.174	.186	15.65	.112	.171	.183
1955	16.30	.107	.159	.170	16.51	.105	.155	.165
1960	17.10	.099	.145	.153	17.38	.097	.140	.148
1965	18.04	.091	.128	.135	18.30	.089	.123	.130
1970	19.31	.079	.105	.110	19.28	.079	.106	.111
1975	20.57	.067	.085	.089	20.26	.070	.090	.094

Year	Region 3 South Level	1q0	5q0	10q0	Region 4 South Level	1q0	5q0	10q0
1940	15.95	.110	.165	.177	13.79	.130	.208	.223
1945	16.51	.105	.155	.165	14.39	.124	.196	.210
1950	17.07	.100	.145	.154	15.00	.118	.184	.197
1955	17.62	.095	.135	.143	15.60	.113	.172	.184
1960	18.18	.090	.125	.132	16.21	.107	.161	.171
1965	18.89	.083	.112	.118	17.02	.100	.146	.155
1970	19.73	.075	.098	.103	18.05	.091	.128	.135
1975	20.57	.067	.085	.089	19.22	.080	.106	.112

TABLE 20 (continued)

Year	Region 5 South Level	Region 5 1q0	Region 5 5q0	Region 5 10q0	Region 6 South Level	Region 6 1q0	Region 6 5q0	Region 6 10q0
1940	9.79	.172	.297	.321	--	--	--	--
1945	10.12	.168	.289	.312	--	--	--	--
1950	10.46	.164	.281	.304	--	--	--	--
1955	10.79	.161	.273	.295	--	--	--	--
1960	11.12	.157	.266	.287	15.91	.110	.166	.178
1965	11.82	.150	.250	.269	17.53	.096	.137	.145
1970	13.08	.137	.222	.239	18.89	.083	.112	.118
1975	14.35	.125	.197	.211	20.24	.070	.090	.094

Year	Region 7 South Level	Region 7 1q0	Region 7 5q0	Region 7 10q0	Whole Country South Level	Whole Country 1q0	Whole Country 5q0	Whole Country 10q0
1940	13.30	.135	.218	.235	12.61	.142	.233	.251
1945	14.10	.127	.201	.216	13.20	.136	.220	.237
1950	14.90	.119	.186	.199	13.80	.130	.208	.223
1955	15.70	.112	.170	.182	14.40	.124	.196	.210
1960	16.51	.105	.155	.165	15.00	.119	.184	.197
1965	17.59	.095	.136	.144	16.06	.109	.163	.174
1970	18.33	.088	.122	.129	17.31	.098	.141	.149
1975	(19.09)	(.081)	(.108)	(.114)	18.55	.086	.118	.125

from the 1977 PNAD. Aside from these two sources of information, analysts have relied mostly on the information provided by age distributions and intercensal comparisons to derive estimates of mortality. The fact that censuses have been carried out at regular intervals during the past 40 years simplifies this task considerably, but it does not eliminate the problems usually encountered in comparing population counts that are subject to different types of errors. Of necessity, therefore, the estimates derived from this type of information are fairly weak and may be subject to considerable bias.

In this analysis, four types of methods have been used to estimate adult mortality levels in Brazil as a whole: the intercensal-comparisons method proposed by Preston (United Nations, 1983), stable and quasi-stable analysis (United Nations, 1967), methods based on the age distribution of deaths (United Nations, 1983), and those that allow the estimation of female adult mortality from information on maternal orphanhood (United Nations, 1983).

The first type of methods (intercensal comparisons) produce reasonable estimates of mortality only when the population under consideration is closed and when the completeness of coverage achieved by the two censuses being compared is similar. Stable analysis and the methods based on the age distribution of deaths assume that the population under consideration is stable. A certain relaxation of this hypothesis is achieved by the use of quasi-stable models in fitting the observed age distributions, but true quasi-stability demands that only mortality be changing. Changes in fertility, such as the ones that Brazil has experienced during at least the last decade, render the use of quasi-stable models inappropriate. Finally, estimation methods based on information about the orphanhood status of respondents produce acceptable estimates of mortality for periods ranging from 10 to 15 years prior to interview. Hence, the 1977 data are likely to yield reasonable mortality estimates for the 1962-67 period, but will have little to say about the recent past.

On the basis of these observations, several conclusions can be drawn. First, regional estimates cannot be obtained in a straightforward manner, because the regional populations are far from being closed and interregional migration makes both intercensal comparisons and the methods based on stable populations useless. If some

correction for migration could be made, the exercise might be more fruitful, but the possibilities provided by the available data (corrections on the basis of place of birth, for example) demand considerable effort and will not in fact produce the desired statistic: that is, the creation of "closed" populations on the basis of place of birth will reveal mortality differentials by place of birth but not by region of current residence, as would be desired. The same type of problem arises when data on orphanhood are considered. Classification of the orphanhood data by the respondent's region of residence at the time of the survey conveys no information about the place of residence of his or her parents. Hence, in a country like Brazil, where there is considerable interregional migration, the "regional" differentials, if any, displayed by this type of information cannot be construed as representing true differences between the various regions.

The second conclusion may be less obvious, but it is probably of greater importance. Taking into account the data sources and the various methods available, as well as the constraints in their use, it is clear that several sets of independent mortality estimates may be derived for approximately the 1945-65 period: intercensal estimates will cover 1945-65; stable and quasi-stable estimates will refer to 1940, 1950, and 1960; death distribution methods applied to the 1960 data will refer to 1960; and estimates derived from maternal orphanhood will cover the 1962-67 period. Hence, the likelihood of establishing with some degree of confidence the mortality levels to which the Brazilian population was subject during that period is high. The same, unfortunately, cannot be said about 1965-75, a period for which the main data sources are the 1970 age distribution and the 1974-75 data on death registration. Derivation of mortality estimates from either of these sources requires the use of methods based on stability or quasi-stability, and, as pointed out earlier, the Brazilian population has not been quasi-stable during the 1970-79 decade (due to a decline in fertility). Hence, there will be greater uncertainty about the levels of adult mortality estimated for the most recent past. This fact highlights the need for future surveys to emphasize the collection of data needed to estimate adult mortality.

The Preston Method of Intercensal Comparisons

Preston (United Nations, 1983) has proposed a method of estimating mortality beyond age 5 on the basis of the age and sex distribution of the population enumerated at two points in time. The essence of the method is to construct from observed population counts and from the age-specific growth rates they imply the equivalent of the ${}_5L_x$ function in a life table. From these ${}_5L_x$ estimates, the expectations of life at different ages can be calculated and compared to those of model life tables, thus exploring their consistency and plausibility.

In the case of Brazil the method was applied separately to each sex for each of the three intercensal periods: 1940-50, 1950-60, and 1960-70. Table 21 shows the results obtained, both in terms of e_x estimates (the expectation of life at age x) and in terms of the equivalent mortality levels in the "West" models of Coale and Demeny (1966). The "West" model was chosen because in most instances it minimized the range of variation of the mortality-level estimates obtained. As we shall see later, the 1960 data on registered deaths also suggest that "West" is the Coale-Demeny model that best approximates Brazilian adult mortality.

Examination of the results presented in Table 21 shows immediately that intercensal comparisons yield a fairly erratic set of estimates. For every intercensal period the range of the estimated mortality levels is never less than two and in several instances it reaches values greater than five. Deviant values seem more likely to occur at the two extremes of the age range, but even for the midrange the estimated levels are far from being smooth or constant. Their characteristics can be grasped more easily by referring to Figures 12 and 13 where they are displayed graphically.

For both males and females it is apparent that the rough shape of the intercensal estimates is maintained from one period to the next, although there are noticeable changes in the overall level of the different curves. In terms of this overall level it is important to note that the 1940-50 estimates are considerably lower (implying higher mortality) than those for the 1950-60 and 1960-70 periods. For females, a clear gradation in overall mortality levels is noticeable from the earliest to the latest period. For males, the near coincidence observed between the 1950-60 and 1960-70 estimates is

TABLE 21 Intercensal Estimates of Adult Mortality, 1940-70: Brazil

	1940-50		1950-60		1960-70	
Age x	e_x	West Mortality Level	e_x	West Mortality Level	e_x	West Mortality Level
Part A: Females						
5	52.64	10.87	61.79	17.08	63.46	18.19
10	48.22	10.28	55.01	15.30	55.77	15.87
15	43.30	9.53	48.57	13.64	49.12	14.11
20	38.44	8.52	43.05	12.28	43.68	12.81
25	34.19	7.66	39.60	12.50	41.18	14.10
30	32.58	9.13	37.54	14.32	39.24	16.18
35	29.58	9.39	33.08	13.50	35.07	16.05
40	25.22	8.02	28.78	12.67	30.27	14.92
45	22.87	9.26	25.76	13.82	26.45	15.03
50	19.56	9.41	21.89	13.59	22.85	15.53
55	17.15	11.06	19.24	15.79	19.39	16.11
60	14.66	12.84	15.49	15.23	15.62	15.59
Part B: Males						
5	49.32	9.95	59.29	17.27	59.90	17.72
10	45.19	9.54	53.00	15.70	53.25	15.90
15	42.50	10.61	49.22	16.28	48.89	16.00
20	40.07	11.83	45.89	17.14	44.70	16.06
25	35.60	11.04	42.02	17.42	41.59	17.00
30	32.69	11.71	38.67	18.35	38.50	18.17
35	29.05	11.65	33.54	17.34	33.90	17.77
40	24.16	9.81	28.63	16.19	28.82	16.47
45	20.90	9.68	24.80	16.26	24.44	15.62
50	17.69	9.44	20.90	15.91	21.01	16.14
55	15.39	10.70	18.03	17.41	17.68	16.55
60	12.91	11.70	14.13	15.67	14.11	15.58

suspect. According to the estimates corresponding to the middle age range (20 to 40), male mortality during the 1960-70 period seems to have been somewhat higher than during 1950-60. In addition, also according to the estimates corresponding to some middle age range (20 to 50, for example), females appear to be subject to higher mortality than males, since their levels are approximately two points lower than those displayed by males.

The ragged shapes displayed by the intercensal estimates are caused mainly by errors in age reporting. Their varying overall levels, however, are not only influenced by these errors, but also by the differential

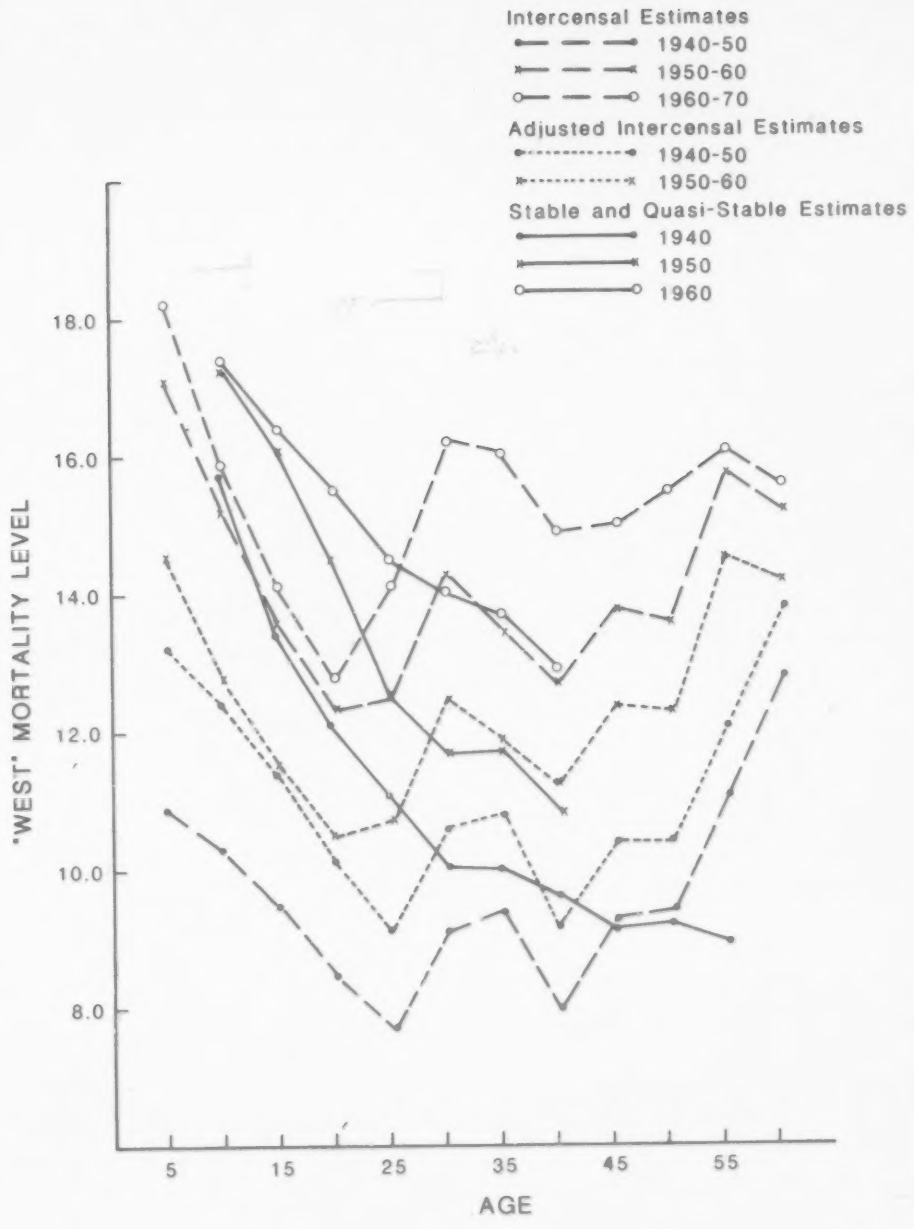


FIGURE 12 Estimated Levels of Adult Mortality Compared, 1940-65, Females: Brazil

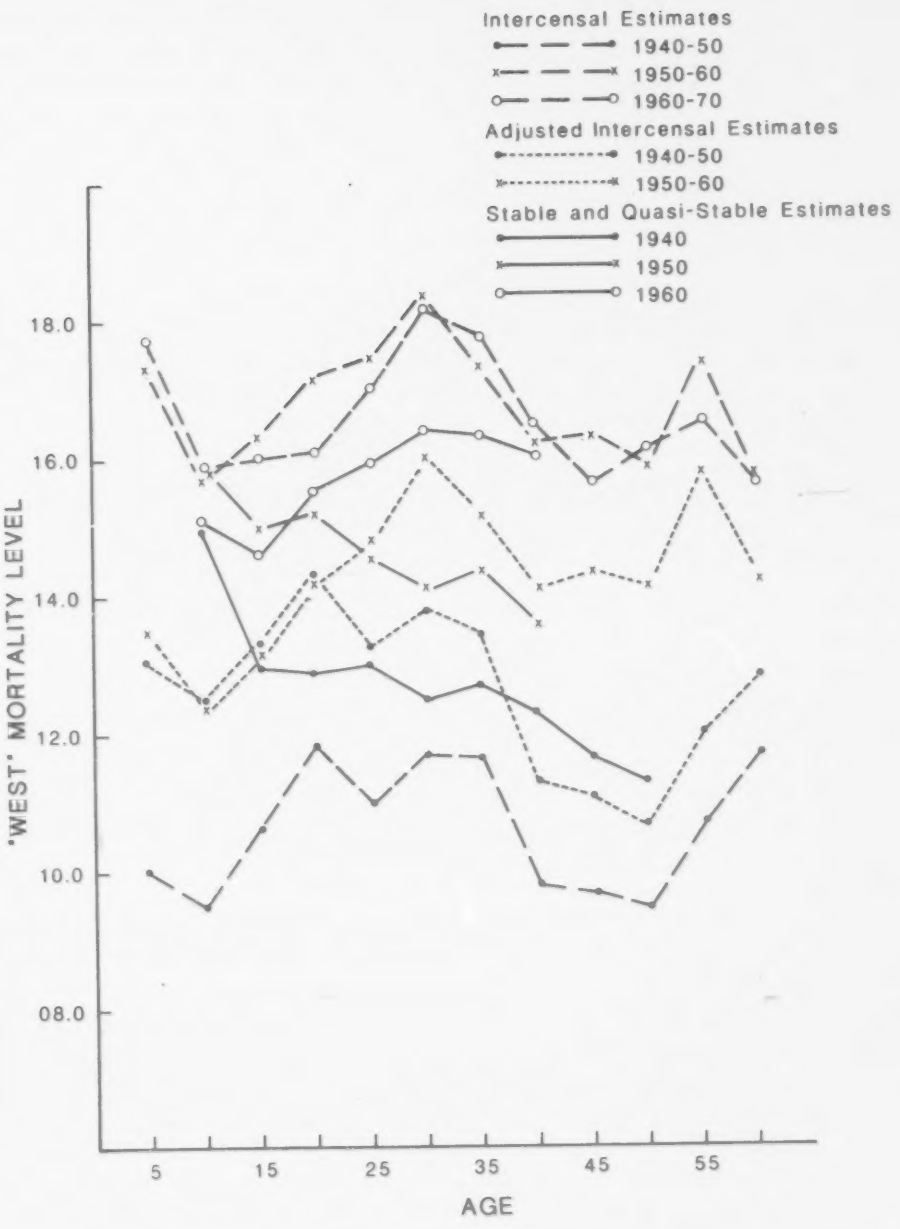


FIGURE 13 Estimated Levels of Adult Mortality Compared, 1940-65, Males: Brazil

degrees of coverage achieved by successive censuses or by the existence of net migration not properly accounted for during the application of the estimation procedure. Although the level of net migration to Brazil was not zero during the 1940-70 period, the evidence available suggests that it was very low.[1] Hence, to simplify the exposition, the biases detected in the overall levels of the intercensal estimates will be attributed mostly to differential census coverage. In particular, the observed trend in the estimates of male mortality, according to which its level increased from approximately 11.6 to 17.6 between the mid-1940s and the mid-1950s only to remain at about the same level or even decrease somewhat toward the mid-1960s, is more likely to be due to the lack of comparability of the census counts than to actual changes of mortality through time. Of course, the main premise underlying this argument is that mortality is more likely to have declined smoothly during the period considered than to have declined abruptly and then even increased at later dates. The second event is not impossible and, given the available evidence, it cannot be disproven. However, the relatively smooth trends displayed by the child mortality estimates presented in the previous section do not suggest that the population was subject to such unconventional changes in mortality levels.

On the other hand, there is no direct evidence concerning the degree of coverage achieved by the different censuses. Brazil has not conducted post-enumeration surveys of any kind, and the assessment of census coverage by analytical means is generally not feasible because of the lack of other reliable data that would allow independent estimation of fertility, mortality, and migration.

Hence, if one rejects the estimates yielded by the observed data as implausible, one's only alternative is to adjust the observed data on the basis of some reasonable assumption. To achieve this, consider the intercensal growth rates calculated directly from the observed data and presented in Table 5. The problems revealed so strikingly by the intercensal estimates are already evident in the trend followed by the intercensal growth rates during the 1940-70 period. Between 1940 and 1950 the growth rate for the country as a whole was 0.0235. It increased dramatically to 0.0295 during the 1950-60 intercensal period only to decrease somewhat during the next ten-year span (to 0.0283). The magnitudes of the increase and of the decline are more pronounced for males than for females, a fact that justifies, to a certain

extent, the relatively greater inconsistencies observed in the male intercensal estimates (Figure 13). The anomalous patterns of growth observed could be easily explained by the fact that the 1950 census undercounted the population to a greater extent than its predecessor or its successors. Indeed, if the 1950 count were too low, the 1940-50 growth rate would be too low, the one for 1950-60 too high, and mortality would seem to have decreased sharply between the two periods. If the 1950 census is ignored and growth rates are calculated for the 1940-60 and 1940-70 periods (see Table 22), they show a plausible increase and fairly similar values for both sexes. Therefore, in order to adjust the apparently deficient 1950 data, the 1940-70 and 1960-70 growth rates were accepted as correct and, assuming a linear change in the growth rate during the 1940-70 period, adjusted growth rate values were calculated for each of the intercensal periods of interest (these are shown in Part B of Table 22).

Using the adjusted 1940-50 growth rates, the total 1950 census count was inflated by about 2.8 percent for males and 2.1 percent for females, the adjusted figures

TABLE 22 Observed and Adjusted Intercensal Growth Rates, 1940-70: Brazil

Intercensal Period	Male	Female
Part A: Observed Growth Rates (percent)		
1940-60	2.65	2.66
1940-70	2.70	2.73
1960-70	2.79	2.87
Part B: Adjusted Growth Rates (percent)		
1940-50	2.61	2.61
1950-60	2.70	2.74
1960-70	2.79	2.87

were redistributed according to the observed 1950 age distribution, and the Preston intercensal method was applied to the adjusted data. Table 23 shows the results obtained and Figures 12 and 13 present them graphically. The estimates of mortality level obtained from the adjusted data still display the ragged behavior they showed before adjustment, but, as expected, their overall levels are modified. For females the "adjusted" estimates imply levels, on average, two points higher for the 1940-50 period and about two points lower for the 1950-60 period than the corresponding ones obtained from the unadjusted data. For males the differences are of similar magnitudes and in identical directions, and they result in estimates whose overall levels seem less inconsistent than those associated with the unadjusted data. Unfortunately, without further analysis of the available data it is not possible at this stage to select a unique sequence of levels indicating the trend mortality has followed in Brazil during the 1940-70 period.

Stable and Quasi-Stable Analyses

If it were true that mortality and fertility had remained nearly constant in Brazil prior to 1940, that the impact of net migration on population growth and age structure were minor, and that the relatively smooth trends in mortality change assumed in the previous section had been operating during the 1940-70 period, the use of stable and quasi-stable methods to estimate mortality would be warranted. In fact, however, even the limited evidence available suggests that several of these requirements are not entirely satisfied. In particular, net immigration to Brazil was substantial up to 1900 and, even during the 1900-40 period, an annual net migration rate of some 0.002 seems to have prevailed (Merrick and Graham, 1979). It is also likely that mortality may have started to decline before 1940, and such decline need not necessarily have followed a smooth trend.

In spite of these observations, it is worthwhile to use stable and quasi-stable analysis to explore the consistency of the data available and to see whether the estimates obtained are, in fact, invalidated by actual deviations from stability.

Because estimation of adult mortality is the goal, stable and quasi-stable populations were fitted on the basis of observed age distributions and rates of natural

TABLE 23 Intercensal Estimates of Adult Mortality Derived from Adjusted Data, 1940-60: Brazil

	1940-50		1950-60	
Age x	e_x	West Mortality Level	e_x	West Mortality Level
Part A: Females				
5	56.15	13.22	57.90	14.46
10	51.21	12.41	51.78	12.83
15	45.78	11.40	45.91	11.50
20	40.47	10.15	40.84	10.46
25	35.87	9.13	37.70	10.76
30	34.07	10.61	35.89	12.46
35	30.78	10.75	31.77	11.89
40	26.17	9.23	27.72	11.25
45	23.64	10.43	24.92	12.38
50	20.15	10.43	21.24	12.34
55	17.64	12.06	18.72	14.57
60	15.01	13.85	15.13	14.20
Part B: Males				
5	53.67	12.99	54.41	13.54
10	48.91	12.36	48.91	12.36
15	45.77	13.25	45.64	13.14
20	42.87	14.33	42.79	14.25
25	37.87	13.18	39.38	14.75
30	34.61	13.76	36.47	15.94
35	30.55	13.44	31.82	15.15
40	25.30	11.32	27.28	14.11
45	21.80	11.06	23.75	14.34
50	18.37	10.69	20.10	14.12
55	15.94	11.98	17.40	15.83
60	13.31	12.84	13.71	14.21

TABLE 24 Adjusted Growth Rates (in percent) for Exact Dates, 1940-70: Brazil

Year	Male	Female
1940	2.57	2.55
1950	2.66	2.68
1960	2.75	2.81
1970	2.84	2.94

increase. Therefore, estimates of the latter are needed for the census dates. Assuming again that growth rates changed linearly between 1940 and 1970, the values presented in Table 24 were calculated from the adjusted growth rates presented in Table 22. Then model stable populations were fitted to the proportions under age x recorded by the 1940 census.

A question arises concerning the family of models to be used in this fitting process. As mentioned earlier, there are reasons to believe that child mortality patterns in Brazil are best represented by the "South" models of the Coale-Demeny set. However, the available evidence on adult mortality suggests that "West" is a better model of mortality over age 15. Therefore, in order to minimize biases introduced by the inadequacy of any single model, a new set of model stable populations was generated by combining models "South" and "West." Specifically, life tables that incorporate the "South" mortality pattern below age 15 and the "West" one thereafter were used to generate the required stable populations. In all cases a life table of a given "South" level was combined with one of the same level in model "West."

Table 25 presents the 1940 proportions under age x and the mortality levels associated with them. It is clear that from age 20 onward the levels associated with the female proportions under age x are consistently lower (by at least two levels in most cases) than those associated with the male proportions. The same type of differential was noticed in the intercensal estimates, and in both cases it may be ascribed to a relative excess of females

TABLE 25 Observed Proportions Under Age x for 1940 and Adult Mortality Estimates Derived by Fitting Stable Populations to the Observed Proportions Under Age x: Brazil

	Male		Female	
Age x	Proportion Under Age x	Mortality Level[a]	Proportion Under Age x	Mortality Level[a]
10	.3002	15.31	.2924	15.69
15	.4309	13.04	.4212	13.39
20	.5360	12.92	.5323	12.06
25	.6249	13.00	.6281	11.05
30	.7046	12.48	.7108	10.04
35	.7675	12.70	.7729	10.13
40	.8240	12.31	.8288	9.59
45	.8727	11.60	.8747	9.08
50	.9108	11.15	.9089	9.18
55	.9419	10.42	.9383	8.88

Note: $r_f = .0255$ and $r_m = .0257$.

[a]Within model stable populations generated by using South patterns of mortality for ages under 15 and West patterns over age 15.

at younger ages. The possibility of its being real is invalidated by evidence presented later.

Assuming that the changes in the growth rates presented in Table 24 are due mainly to changing mortality, the 1950 and 1960 populations would be quasi-stable and their mortality levels might be estimated by using the method described in Manual IV (United Nations, 1967). Using models derived from the "South-West" combination described above, the mortality levels associated with the proportions under age x observed in 1950 and 1960 were estimated (see Table 26). It is again apparent that the estimates associated with the proportions of females under age 20 and over are lower than the corresponding ones for males. That is, the age-misreporting pattern that is responsible for the sex differentials in mortality revealed by the 1940 census data is maintained in later censuses. Such patterns of age misreporting are fairly common in Latin America (United Nations, 1967) and usually preclude the use of the female age distribution for the estimation of adult mortality.

TABLE 26 Observed Proportions Under Age x, Adult Mortality Estimates Derived by Fitting Quasi-Stable Populations to the Observed Proportions Under Age x and Birth-Rate Equivalents, 1950 and 1960: Brazil

	1950 Census			1960 Census		
Age x	Proportion Under Age x	Mortality Level[a]	Adjusted Birth Rate	Proportion Under Age x	Mortality Level[a]	Adjusted Birth Rate
Part A: Females						
10	.2920	17.28	.0382	.2991	17.39	.0392
15	.4129	16.11	.0396	.4207	16.46	.0404
20	.5228	14.55	.0418	.5268	15.53	.0416
25	.6231	12.51	.0451	.6193	14.54	.0431
30	.7039	11.64	.0468	.6962	14.05	.0438
35	.7664	11.71	.0466	.7608	13.73	.0443
40	.8247	10.81	.0485	.8176	12.95	.0456
Part B: Males						
10	.3018	15.88	.0410	.3101	15.11	.0429
15	.4244	15.03	.0422	.4329	14.61	.0437
20	.5267	15.17	.0420	.5315	15.50	.0424
25	.6190	14.55	.0429	.6170	15.93	.0418
30	.6976	14.09	.0436	.6897	16.37	.0412
35	.7604	14.39	.0432	.7541	16.35	.0412
40	.8194	13.57	.0445	.8105	16.02	.0417

[a]within model stable populations generated by using South patterns of mortality for ages under 15 and West patterns over age 15.

To assess the consistency of the estimates based on stable and quasi-stable models, their values were plotted in Figures 12 and 13 to facilitate their comparison with the intercensal estimates presented in the previous section. For females, the intercensal estimates display such a sharply declining trend below age 30 that comparisons between them and almost any other set of estimates would be inconclusive. Over age 30, however, the somewhat more acceptable trend of the stable and quasi-stable estimates allows some type of rough evaluation, the main results of which are as follows: the 1940 stable estimates appear to be consistent with the 1940-50 intercensal estimates derived from adjusted data; the fact that the 1940 stable estimates fall almost consistently above the 1940-50 intercensal estimates derived from the observed data suggests that the latter are inadequate. A similar observation can be made about the 1960 quasi-stable estimates and those for 1950-60 derived from unadjusted data. On the whole, the intercensal estimates derived from the adjusted 1950 data display a more satisfactory relationship with respect to the stable and quasi-stable estimates than do their counterparts derived from the observed data. This conclusion becomes stronger when the estimates for males are considered. In this case, the stable and quasi-stable estimates over age 15 display acceptable trends and are easier to compare with the intercensal estimates associated with ages 25 to 50, say. It is clear that the type of relationship expected (the 1940 estimates being lower than those for 1940-50, and so on) is displayed only by the adjusted 1940-50, 1950-60, and the unadjusted 1960-70 estimates. As compared with the stable and quasi-stable estimates, the 1940-50 and 1950-60 intercensal estimates derived from unadjusted data are inadequate.

These comparisons reveal that, on the whole, the stable and quasi-stable estimates are not completely invalidated by being derived from a population which does not meet strictly the requirements for stability. However, these conclusions are weaker than they may seem at first sight because both the adjusted intercensal estimates and the stable and quasi-stable set depend on the assumptions made about the evolution of the growth rate through time. On this basis, therefore, they would be expected to be fairly consistent among themselves. It is reassuring to find that the data for males display the expected consistency. In the case of females, however, although some consistency is apparent, it can be established only with

great ambiguity. This observation suggests that the female estimates are more likely to be flawed.

Methods Based on the Age Distribution of Deaths

Brass (1975) was the first to propose a method that uses the enumerated population and the number of reported deaths, both classified by age, to estimate the completeness of death registration over age 5 and which, therefore, permits the construction of an adjusted life table for adult ages. More recently Preston et al. (1980) have proposed a method based on the same general principles that achieves a similar goal while providing further evidence about the quality and possible inconsistencies of the observed data. Both the Brass and the Preston methods assume that the population under consideration is stable and that the completeness of death registration with respect to the completeness of enumeration of the population does not vary with age. In addition, the Preston method requires that the rate of growth of the stable population be known.

In the case of Brazil, there are two data sets available that make it possible to apply this method. The first refers to 1960 and consists of the number of deaths registered during the year and the population enumerated by the 1960 census. The second is constituted by the number of registered deaths occurring in 1975 and requires that an adequate population be estimated for the period (since no census took place that year). Strictly speaking, only the first set is a truly adequate input for the methods mentioned above, since the Brazilian population in 1960 was closer to being stable than the one in 1975. However, lack of other data referring to the more recent periods impels us to apply these methods even for 1975, in order to assess roughly the quality of the data.

Estimates for 1960

Table 27 presents the completeness estimates obtained when the method proposed by Preston et al. is applied to the 1960 data (United Nations, 1983). The main principle underlying this method is that, in a stable population, the growth rate and the age distribution of deaths over age x can be used to estimate the population of exact age x (essentially, the growth rate is used to expand the

TABLE 27 Estimates of Death Registration Completeness for Different Truncation Ages by Sex, 1960: Brazil

	Truncation Age, Male			Truncation Age, Female		
Age x	70	60	50	70	60	50
0	.555	.570	.587	.516	.514	.514
5	.545	.559	.575	.503	.501	.500
10	.551	.566	.583	.504	.501	.499
15	.554	.570	.588	.505	.501	.498
20	.549	.566	.583	.507	.503	.499
25	.544	.560	.577	.513	.507	.502
30	.537	.552	.567	.516	.510	.503
35	.533	.548	.560	.520	.512	.501
40	.533	.549	.558	.533	.525	.512
45	.534	.551	.554	.542	.532	.510
50	.540	.562	--	.558	.549	--
55	.547	.583	--	.577	.582	--
60	.534	--	--	.574	--	--
65	.624	--	--	.681	--	--
Mean[a]	.542	.558	.572	.516	.510	.503

Note: $r_f = .0281$ and $r_m = .0275$.

[a]From age 5 to 45.

reported number of deaths over age x). The ratio of the estimated population to the one observed is then used as an indicator of the level of completeness of death recording. Whenever this level is more or less constant with respect to age and the growth rate is known, the ratios corresponding to populations of different ages should be the same. In practice, however, an accurate determination of the denominators of these ratios (the "observed" population of exact age x) is often impossible because of age-reporting errors at the time of enumeration. In order to minimize the effects of these errors it is recommended that both numerator and denominator be cumulated. Therefore, estimates of completeness are derived for each of the age groups from x to z, where z is the "truncation age."

The completeness estimates obtained by using this method may be biased by different types of errors affecting the input data. Two types of errors can be distinguished: those in the estimated growth rate and those present in the age distribution of either deaths or the observed population. Errors in the growth rate

produce typical deviations of the completeness estimates from the horizontal line they should ideally follow. For instance, a growth rate that is too high will produce estimates that decrease steadily as age increases, and the opposite trend will be noticed if the growth rate is too low. In both cases, the increasing or decreasing trends will be almost linear with respect to age.

Exaggeration of the reported age at death will also produce estimates of completeness that increase with age. However, unless the tendency to exaggerate age at death starts very early, the pattern displayed by the completeness estimates will deviate noticeably from a straight line. Specifically, exaggeration of age at death beyond age y will produce estimates that are fairly constant up to age y and that increase substantially thereafter. In addition, if a new set of estimates is calculated by using y as truncation age, it will be almost constant and at a level lower than that implied by the flat portion of the estimates obtained when truncation was effected at an age greater than y.

Another type of age-reporting error that may produce a set of completeness estimates with a pattern similar to that observed when age at death is exaggerated is the shift of older persons to younger ages. For example, suppose that a certain proportion of those aged y to z declare themselves as belonging to age group x to y-1. Then, even if age at death is correctly reported and completeness of death registration is invariant with age, when the latter is estimated by truncating at age z, the completeness estimates over age y will appear to be too high and only those below age x will be correct. In this case, truncation at age y will produce completeness estimates that are correct up to age x and decline thereafter. Only truncation at age x will produce a set of horizontal and accurate completeness estimates.

Because no data set is entirely free from errors such as these, it is always important to calculate sets of completeness estimates with different truncation ages. Table 27 presents estimates for three truncation ages (50, 60, and 70) for the 1960 data. To assess their consistency, plots of each set are presented in Figure 14.

The patterns displayed by the estimates for males suggest that errors in the age distribution of the 1960 population are greater than any that may be affecting the age distribution of deaths. When the data are truncated at age 70, the very high completeness estimate obtained at age 65 is due mainly to an undercount of the popula-

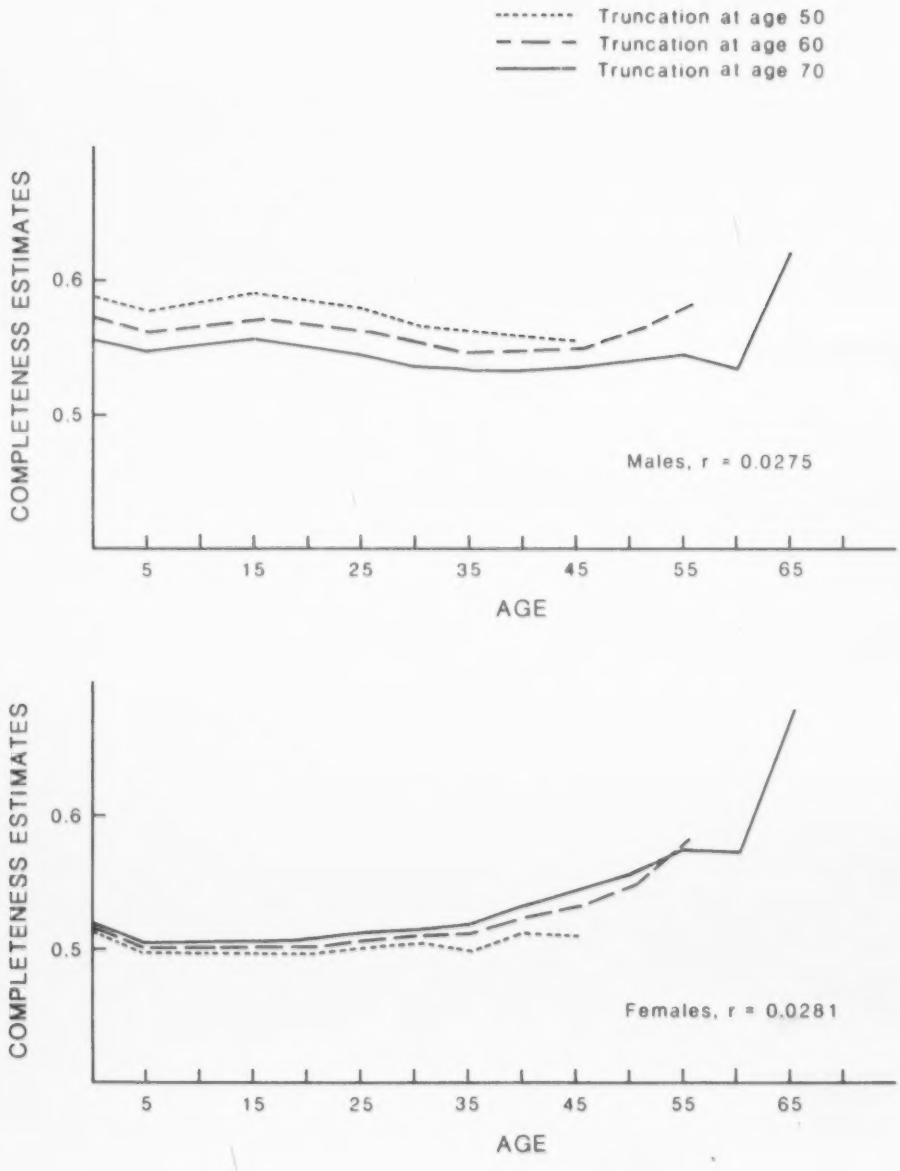


FIGURE 14 Estimates of the Completeness of Death Registration Relative to the 1960 Census Count: Brazil

tion aged 65-69. The deficit in this age group was probably shifted to younger ages, because the completeness estimates below age 60 are fairly similar. The same type of phenomenon seems to be affecting the estimates derived from data truncated at age 60. Those obtained by truncating at 50 display no obvious distortions of this type. In addition, the upward trend observed in the estimates above age 45 cannot be explained by exaggeration of age at death because the latter would result in lower mean completeness levels the younger the truncation age (see Table 27).

The increase of mean completeness levels with truncation age is unexpected and may be due to a variety of causes: a greater relative undercount of the population 0-49 than that affecting 0-59 or 0-69, net and increasing upward shifts of the population outside of these age groups, understatement of age at death for those dying above age 50, or biases introduced by the estimation procedure itself (the estimation of the population of exact age z, the truncation age, depends on the adequacy of the "West" model as a representation of the Brazilian experience). It is not possible to single out any one of these causes as the most likely. Fortunately, the differences in mean completeness are small (3 percent) and any estimate ranging between 54 and 57 percent would be adequate. The former was used to derive the adjusted age-specific mortality rates shown in Table 28.

The completeness estimates for females (see Figure 14) display a pattern consistent with both some degree of age misreporting, which causes substantial deficits in certain age groups (such as 65-69), and a certain degree of exaggeration of the age at death. The latter is substantiated by the fact that the mean completeness estimates between ages 5 and 45 decline with truncation age and by the shapes of the curves depicting the different sets of estimates: the one associated with truncation at age 50 is almost constant, while those associated with truncation ages 60 and 70 display sharp increases at the upper end of the age range. In this case, therefore, the estimates associated with truncation age 50 should be preferred. Hence, a completeness estimate of 50 percent was used in adjusting the central mortality rates presented in Table 28.

Before discussing the patterns displayed by these mortality rates it is important to note that the estimates presented in Figure 14 give no indication that the growth rates used in deriving them may be unacceptable. Valida-

TABLE 28 Adjusted Age-Specific Mortality Rates and Corresponding West Mortality Levels, by Sex, 1960: Brazil

	Male		Female	
Age x	$_5m_x$	West Mortality Level	$_5m_x$	West Mortality Level
5	.00207	17.79	.00228	16.84
10	.00165	17.45	.00129	18.29
15	.00225	18.42	.00199	18.17
20	.00363	17.58	.00330	17.06
25	.00470	16.24	.00435	16.25
30	.00563	15.88	.00542	15.69
35	.00719	15.46	.00674	15.05
40	.00891	15.72	.00788	14.89
45	.01229	15.16	.00959	14.72
50	.01627	15.68	.01260	15.17
Median Level		16.06		15.97

Note: Adjustment factor is 1.845 for males and 1.988 for females.

tion of the growth rate estimated for 1960 would, to a certain extent, validate the assumption made about the trends followed by the rate of growth during the 1940-70 period. In this respect the Brass growth balance equation (GBE) method can serve as a confirmatory tool because it allows the estimation of both the rate of growth and the completeness of death registration. Table 29 shows the estimates obtained by applying the GBE method. For males, the near coincidence of the GBE estimates ($r = 0.0272$ and $C = 0.535$) with those used or derived earlier ($r = 0.0271$ and $C = 0.542$) is very reassuring. For females, the growth rates are acceptably similar (0.0283 according to the GBE and 0.0281 according to our independent estimates) but the completeness estimates differ by a greater amount (about 4 percentage points). However, on the whole, these differences are minor and the generally good quality of the data at hand ought to be stressed.

As explained above, having selected estimates of death registration completeness for males and females (54.2 and 50.3 percent, respectively), their reciprocals were used

TABLE 29 Application of the Growth Balance Equation Method by Sex, 1960: Brazil

	Male		Female	
Age x	b(x+)	d(x+)	b(x+)	d(x+)
5	.0370	.0046	.0355[a]	.0039[a]
10	.0392	.0053	.0376	.0044
15	.0390	.0063	.0393	.0052
20	.0393	.0073	.0420	.0062
25	.0413	.0085	.0445	.0073
30	.0442	.0099	.0466	.0086
35	.0491	.0117	.0507	.0101
40	.0547	.0140	.0558	.0122
45	.0613	.0171	.0602	.0149
50	.0698[a]	.0211[a]	.0678	.0188
Growth Rate (percent)		2.72		2.83
Estimated Completeness (percent)		53.45		46.37

[a]Points excluded from the fitting process.

to adjust the observed age-specific mortality rates. The resulting adjusted rates and the mortality levels they imply in the "West" models are displayed in Table 28. The "West" model was selected because it is the one (within the four sets proposed by Coale and Demeny) that produces the least variable set of levels. However, as Table 28 shows, even the least variable set has a fairly wide range of variation. This outcome complicates the task of selecting one single level to represent mortality risks. To minimize the influence that undetected (or undetectable) outliers might have on this representative level, the median level was selected in each case: 16.06 for males and 15.97 for females. The similarity of these estimates casts doubts on the wide male-female mortality differential suggested by the intercensal or the stable and quasi-stable mortality estimates. This point will be discussed at greater length later.

Estimates for 1975

The application of the Preston et al. method to the 1975 data on death registration requires that estimates of the

growth rate and of the population classified by sex and age be available for 1975. There are several ways of estimating the latter (using a growth rate to expand the 1970 population, using some preliminary estimate of mortality to project the 1970 population, etc.), but most of them depend on estimates that already incorporate some assumption about mortality and are, therefore, not very satisfactory. Fortunately, data on the age distribution of the Brazilian population around 1975 are not entirely lacking. In 1976, with the purpose of updating the 1970 sampling frame on which the PNAD samples were based, a complete listing of the population living in a sample of census tracks was undertaken. The results of this listing (1976 Listagem) for the PNAD regions are available and are presented in Table 30, together with the number of deaths registered in 1975 classified by sex. These data will be the input for the Preston et al. method.

TABLE 30 Estimated Population and Registered Deaths by Sex and Age, 1975: Brazil

Age Group	Male		Female	
	Population	Deaths	Population	Deaths
0-4	6,456,800	157,361	6,302,878	126,598
5-9	6,350,383	7,749	6,228,064	5,825
10-14	6,283,273	5,803	6,292,291	3,979
15-19	5,404,929	8,635	5,700,627	5,471
20-24	4,429,342	11,291	4,750,227	6,502
25-29	3,501,416	11,290	3,744,449	6,631
30-34	2,847,815	11,939	2,987,693	7,373
35-39	2,562,934	14,433	2,722,622	9,063
40-44	2,304,114	16,195	2,345,526	10,051
45-49	1,957,600	19,136	1,985,732	11,433
50-54	1,647,705	21,406	1,632,546	12,618
55-59	1,208,773	22,234	1,213,221	14,267
60-64	1,001,505	26,831	1,047,600	18,069
65-69	774,917	29,985	786,689	20,746
70+	954,680	85,737	1,133,176	82,613

Note: Source for estimated population is 1976 Listagem deflated to represent the population in the PNAD regions in mid-1975.

Preliminary results from the 1980 census suggest that Brazil's population grew at a rate of about 0.025 per annum between 1970 and 1980. This value contrasts with the 0.283 estimated for 1960-70. In addition, it was estimated earlier that by 1970 the female population was growing at a rate of 0.0294, while males were growing at a rate of 0.0284 (see Table 24). That is, in the absence of a fertility decline, the growth rate by 1975 would have been substantially higher than the preliminary 1980 census results suggest.

In order to decide which of these growth rates to use in applying the Preston et al. method, we must recall that this method is based on the assumption of stability. When a quasi-stable population is considered, the growth rate at the time of enumeration is a satisfactory proxy for the stable growth rate required as input. But in cases where the birth rate has been declining, perhaps the best choice is the growth rate of the population 5 and over, or even 10 and over, depending on when fertility started to decline. In the case at hand, the growth rate estimates for 1970 were assumed to represent those of the population five and over in 1975, and were used as input in applying the method.

Table 31 shows the completeness estimates obtained by using different truncation ages, and Figure 15 displays plots of these estimates. It is immediately evident that the estimates oscillate with age, although in most cases the oscillations observed occur around a horizontal line (that is, the estimates neither increase nor decrease consistently with age). Such oscillating patterns are typical of destabilized populations, although their amplitude in the Brazilian case seems somewhat large. In no case do these curves suggest that the growth rate estimates used are inadequate. The slightly declining trend of the estimates for males derived by truncating at age 70 is more likely to be due to overestimation of the population aged 60-64 and 65-69 than to problems related to the growth rate.

As in the case of males in 1960, the mean completeness levels estimated for both males and females in 1975 increase as truncation age decreases. Several of the possible causes of this pattern have been mentioned above, but once more it is not possible to select one as the most likely. However, the completeness curves associated with truncation age 50 appear to be less distorted than the others and, in consequence, their means over age 5 will be adopted as completeness estimates.

TABLE 31 Estimates of Death Registration Completeness for Different Truncation Ages by Sex, 1975: Brazil

	Truncation Age, Male			Truncation Age, Female		
Age x	70	60	50	70	60	50
0	1.040	1.082	1.121	.882	.908	.931
5	1.001	1.041	1.077	.842	.866	.885
10	0.987	1.027	1.062	.823	.846	.862
15	0.999	1.041	1.079	.827	.850	.866
20	1.014	1.059	1.102	.843	.867	.884
25	1.021	1.071	1.120	.857	.884	.904
30	1.011	1.062	1.113	.859	.887	.906
35	0.985	1.034	1.079	.845	.871	.883
40	0.965	1.014	1.049	.844	.870	.875
45	0.959	1.010	1.038	.848	.876	.871
50	0.957	1.015	--	.858	.895	--
55	0.969	1.069	--	.873	.945	--
60	0.932	--	--	.846	--	--
65	0.901	--	--	.853	--	--
Mean[a]	0.994	1.040	1.080	.843	.869	.882

Note: $r_m = .0284$ and $r_f = .0294$.

[a]For ages 5 to 45.

These estimates (1.08 percent for males and 0.88 percent for females) may seem, at first sight, fairly high. One must recall, however, that the Listagem figures refer only to the population in the PNAD regions, that is, they exclude all the inhabitants of rural Region 7 (approximately 5 percent of the Brazilian population), and that they do not result from the total enumeration of the population. Therefore, their overall magnitude may not be correct (specifically, it is likely to be too low). However, even if this fact is taken into account, the estimates adopted indicate that there is a substantial differential in the completeness of death registration by sex (a differential that was fairly small in 1960) and that for males the absolute level of completeness of death registration is likely to be higher than 90 percent. In other words, the registration of male deaths appears to have been remarkably complete in 1975.

Using the adjustment factors implied by the estimated completeness levels, adjusted age-specific mortality rates were calculated. These rates and the levels they

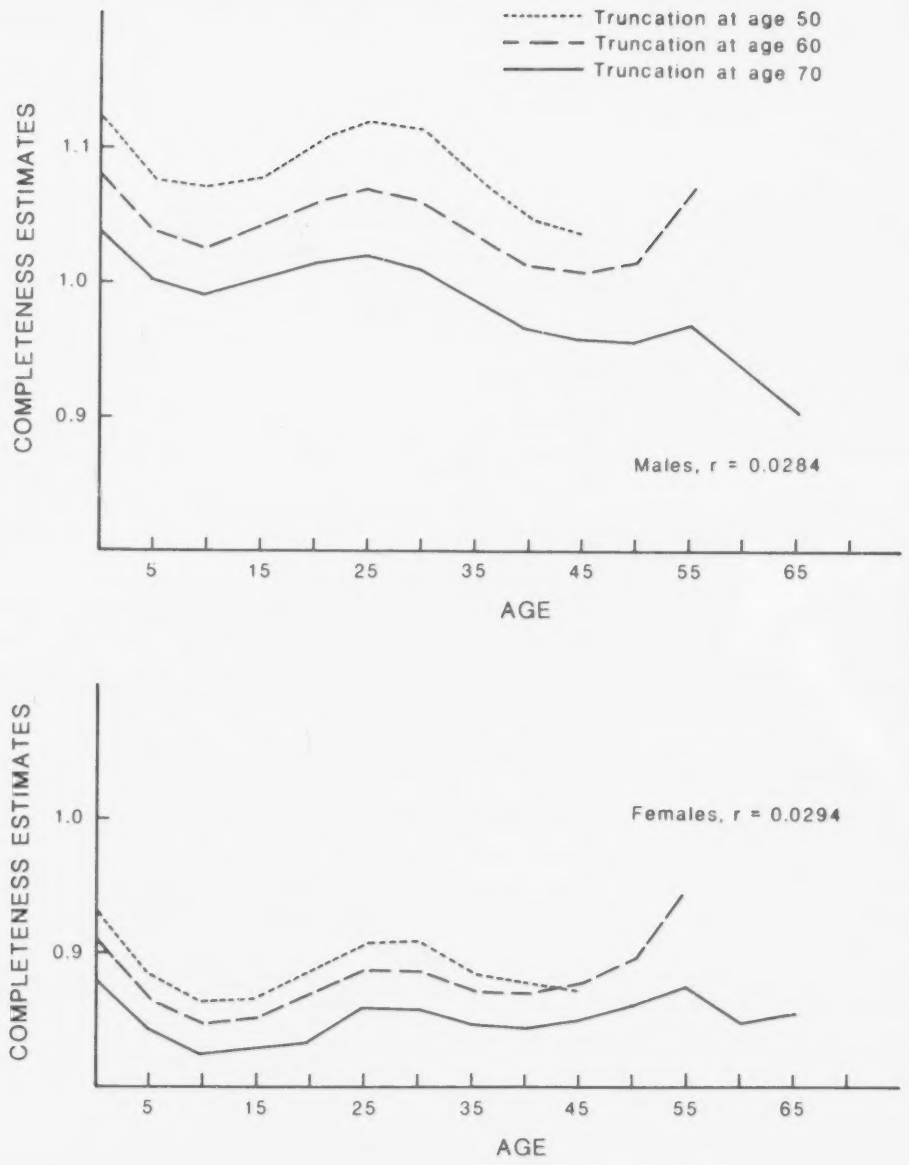


FIGURE 15 Estimates of the Completeness of Death Registration in 1975 Relative to the 1976 Listagem: Brazil

TABLE 32 Adjusted Age-Specific Mortality Rates and Corresponding West Mortality Levels by Sex, 1975: Brazil

	Male		Female	
Age x	$_5m_x$	West Mortality Level	$_5m_x$	West Mortality Level
5	.00113	20.45	.00110	19.74
10	.00086	20.61	.00074	20.16
15	.00148	20.67	.00113	20.34
20	.00236	20.08	.00161	20.26
25	.00299	19.08	.00208	19.98
30	.00388	18.34	.00290	19.25
35	.00521	17.80	.00392	18.68
40	.00651	18.18	.00504	18.42
45	.00905	18.17	.00677	18.20
50	.01203	19.06	.00909	18.68
55	.01703	19.79	.01383	18.04
Median		19.08		19.25

Note: Adjustment factor is .926 for males and 1.176 for females.

imply in the "West" models are presented in Table 32. "West" was chosen because it minimizes the variability of the estimated levels. However, the latter still cover a fairly wide range of possibilities. As in the case of the 1960 data, representative levels were selected by calculating the median of each set. The resulting estimates, 19.08 for males and 19.25 for females, suggest yet again that sex differentials in mortality are not greater than those embodied by the models themselves. Furthermore, these levels do not appear to be inconsistent with those obtained for the same period on the basis of information on child mortality.

Estimates Based on Information on Maternal Orphanhood

The 1977 PNAD survey included a question about the survivorship status of each respondent's mother. The data resulting from it are available for six of the seven PNAD regions (Region 1 is missing) and they allow the estimation of female adult mortality via the method proposed by

TABLE 33 Estimation of Female Adult Mortality on the Basis of Data on Maternal Orphanhood: Brazil

Age Group	Number of Respondents[a] With Mother Alive	With Mother Dead	Age N	$\frac{l(25+N)}{l(25)}$	West Mortality Level	Reference Date
15-19	10,569,477	624,040	20	.9394	19.58	1969.2
20-24	8,386,616	835,993	25	.9060	19.13	1967.6
25-29	6,309,334	1,080,830	30	.8530	18.35	1965.8
30-34	4,547,572	1,284,277	35	.7817	17.66	1965.2
35-39	3,626,397	1,581,893	40	.6954	17.47	1964.4
40-44	2,536,577	1,862,013	45	.5682	16.88	1963.9
45-49	1,801,867	2,165,130	50	.4089	16.27	1962.6
50-54	1,493,720	3,967,214	--	--	--	--

Note: The mean age of mothers at the birth of their children is 27.26 years.

[a]Excluding Region 1.

Brass and Hill (1973). Table 33 presents the basic data and the estimated probabilities of survivorship from age 25 to age 25 + N for N ranging from 20 to 50. So that the consistency of these survivorship probabilities can be assessed, they are accompanied by the "West" mortality levels they imply.

The set of estimated levels declines steadily as the age of respondent increases. Since the older the respondent, the earlier the time to which the estimates refer, a declining trend with age would be expected. However, a more stringent test of the consistency of these estimates is not possible without estimates of their reference dates. The procedure proposed by Brass and Bamgboye (1981) has been used to estimate these dates. They are also shown in Table 33 and imply that female adult mortality in Brazil (excluding Region 1) declined by about three levels in roughly 7 years. Such a rapid mortality decline is not substantiated by other evidence, and it suggests that at least some of the estimates derived from information on orphanhood may be biased. As we shall see later, those associated with respondents aged 15 to 29 are too low (that is, the mortality levels they imply in the model tables are too high).

This type of bias is often encountered in the estimates derived from data referring to younger respondents. It has traditionally been explained by the "adoption effect," which results from the tendency of respondents

whose biological mother has died, but whose mother by adoption is alive, not to report themselves as orphans. This bias may also stem in part from the fact that younger respondents are more likely to live in the parental home in the company of their siblings. Therefore, a survey gathering information about every household member is likely to overrepresent the survivorship status of mothers whose offspring still live in the same household, and mother's survival may be highly correlated with this event. Whatever the cause, the 1(25+N)/1(25) estimates for N ranging from 20 to 30 cannot be accepted.

Another aspect of the estimates based on orphanhood data that is open to question is their representativity. That is, to what extent does the exclusion of Region 1 bias the resulting estimates? The magnitude of this bias would be minimal if mortality levels among females of Region 1 were similar to those prevalent in the rest of the country. Validation of this proposition, as well as evidence regarding the regional variation of mortality according to the orphanhood data, can be obtained by comparing the mortality levels implied by the survivorship probabilities estimated on the basis of the orphanhood data classified by region. Table 34 shows two levels for each region, the first representing a rough estimate for 1963 and the second being one for 1965. The corresponding values for Brazil without Region 1 are displayed under the label "weighted average." According to Table 34 the estimated levels for Region 2 are very similar to those of the "weighted average." Since Region 1 is expected to display levels comparable to those of Region 2, the similarity just noted implies that the "weighted average" is very likely to be similar to the true figure for Brazil as a whole. In the rest of this chapter, this assumption will be adopted as valid.

In principle, Table 34 also conveys some information about regional differentials in mortality. However, disregarding Region 7, the estimates display a fair degree of homogeneity (especially those for 1965) and, in general, the differentials they imply do not conform to those revealed by the child mortality estimates. For example, Region 5 does not appear to be subject to particularly high mortality, nor does Region 3 display very low mortality levels. These surprising outcomes are due to the very nature of the information on orphanhood: the data used as input have been classified by place of residence of respondent and <u>not</u> by mother's place of residence. Therefore, because the levels of inter-

TABLE 34 Regional Differentials in Female Adult Mortality as Estimated from Data on Maternal Orphanhood: Brazil

Region	West Mortality Level	
	Around 1963[a]	Around 1965[b]
1	--	--
2	16.38	17.40
3	15.54	17.70
4	16.30	16.82
5	16.56	17.33
6	17.92	17.11
7[c]	19.24	19.41
Weighted Average	16.58	17.57

[a]Average of the levels implied by 1(70)/1(25) and 1(75/1(25).
[b]Average of the levels implied by 1(60)/1(25) and 1(65)/1(25).
[c]Urban areas only.

regional migration during the past 40 or 50 years have been substantial, the orphanhood data classified by respondent's region of residence cannot be expected to reflect adequately mortality differentials that depend on the region of residence of the respondent's mother. In consequence, the type of data available do not allow the estimation of mortality differentials by region.

Comparison and Assessment of the Adult Mortality Estimates

Having presented the mortality estimates derived from different sources and through a variety of estimation methods, it is now possible to compare and evaluate them. Consider first the estimates derived by inter-censal comparisons and stable or quasi-stable analysis. A preliminary comparison of the two sets has already been carried out earlier (see Figures 12 and 13), where it was

noted that both the intercensal estimates and those derived by fitting stable or quasi-stable populations display a fairly wide range of variation. It was also established that the intercensal estimates based on the adjusted 1950 data are to be preferred over those derived from the observed census counts. However, no definite set of estimates representing the evolution of mortality during the 1940-60 period was selected. To perform this selection, consider the estimates as displayed in Figures 12 and 13. It is clear that with sets of estimates spanning a range of three or four levels in most instances, some degree of arbitrariness will have to be exercised in selecting "the most representative" of each set. Two main guidelines were adopted in selecting the representative estimates: first, that estimates near the two extremes of the age range used in each case (except, possibly, the quasi-stable estimates near the upper end) are more likely to be biased; and, second, because on the basis of the child mortality estimates mortality seems to have been declining steadily during the 1940-60 period, the representative estimates selected should, if possible, be consistent with the existence of this decline.

In the case of females, if the estimates associated with ages 15 or younger are disregarded, selecting a set that shows a steady decline with time narrows the possibilities considerably. We have decided to adopt those associated with age 30 in every case (selection of the stable and quasi-stable estimates associated with age 35 would modify the selected set only slightly). For males, whose sets of estimates usually span more narrow ranges, the ones selected were the average of those associated with ages 25, 30, and 35. Table 35 shows the selected sets by sex and it also presents the estimates derived from the death registration data.

To facilitate comparisons, the estimates in Table 35, together with those obtained from information on maternal orphanhood, have been plotted in Figure 16. It is immediately evident that the male intercensal and stable or quasi-stable estimates are consistent both with those obtained from death registration and with those derived from orphanhood information of older respondents, even though the latter refer only to female mortality. In contrast, the intercensal and stable estimates for females fall below those estimated from all other sources. The large discrepancy of the male-female mortality estimates derived from intercensal and stable analysis has already been noted and the possibility of it

TABLE 35 Selected Estimates of Adult Mortality by Sex in Terms of West Mortality Levels, 1940-75: Brazil

Type of Estimate and Reference Date	Male	Female
Stable and Quasi-Stable		
1940	12.73	10.04
1950	14.34	11.64
1960	16.22	14.05
Intercensal		
1940-50	13.46	10.69
1950-60	15.28	12.46
1960-70	17.65(17.20)[a]	16.18
Death Registration		
1960	16.06	15.97
1975	19.08	19.25

[a]The level in parenthesis is a "smoothed" value used in deriving the final mortality estimates.

being due mainly to greater distortions of the female age distributions relative to those affecting males has been advanced. Analysis of the reported age distributions via a method recently proposed by Coale (United Nations, 1983) suggests that this is indeed the case, and the patterns of age misreporting usually observed among Latin American females (United Nations, 1967) also support this possibility. Furthermore, evidence obtained from other sources (death registration and orphanhood data) does not suggest that the male-female mortality differentials in Brazil are greater than those embodied by the model life tables. Therefore, in deriving a final set of adult mortality estimates for Brazil as a whole, the intercensal and stable estimates for females were rejected, and it was assumed instead that, as suggested by the death registration data, adult mortality differentials by sex are adequately represented by the "West" models.

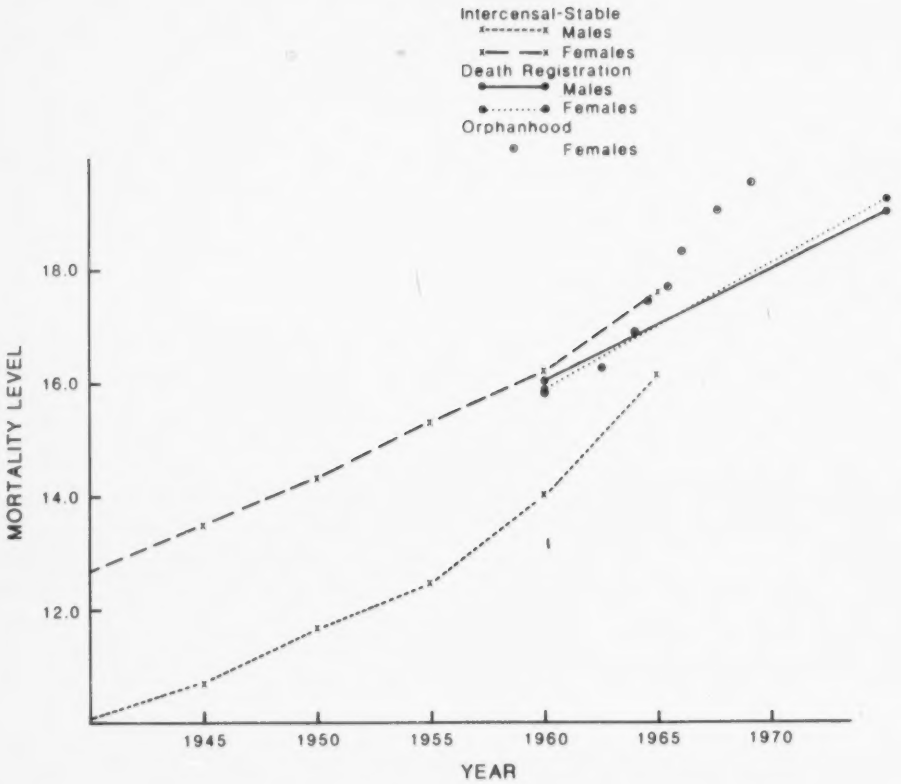


FIGURE 16 Selected Estimates of Adult Mortality, 1940-75: Brazil

A Final Set of Mortality Estimates for Brazil and Its Regions

Using the "West" mortality levels for males presented in Table 35 and assuming that the intercensal estimates refer to the middle of the intercensal period, linear interpolation by sections was used to derive estimates of the mortality levels prevalent during each year of the 1940-75 period. The corresponding "South" mortality levels derived from child mortality estimates were already available. Therefore, complete life tables by single-year periods could be calculated by splicing life tables for children (up to age 15) with the corresponding life tables for adults (over age 15). Table 36 presents estimates of the expectation of life at birth (e_0) and of the expectation of life at age 5 (e_5) obtained in

TABLE 36 Final Estimates of Adult Mortality in Terms of West Mortality Levels and Estimated Values of e_0 and e_5 by Sex, 1940-75: Brazil

Year	West Mortality Level	Male		Female	
		e_0	e_5	e_0	e_5
Part A: Whole Country					
1940	12.73	44.50	53.18	47.01	55.41
1945	13.46	46.01	54.18	48.57	56.44
1950	14.34	47.61	55.31	50.26	57.62
1955	15.28	49.25	56.48	52.06	58.93
1960	16.22	50.93	57.67	53.89	60.26
1965	17.20	53.32	59.05	56.46	61.78
1970	18.14	55.93	60.43	59.25	63.29
1975	19.08	58.66	61.82	62.00	64.77
Part B: Regions					
Region 1					
1940	14.04	47.49	55.01	50.11	57.28
1945	14.98	49.41	56.23	52.21	58.66
1950	16.10	51.52	57.66	54.50	60.26
1955	17.30	53.74	59.22	56.90	61.96
1960	18.49	56.01	60.81	59.34	63.69
1965	19.33	58.15	62.02	61.61	64.99
1970	20.24	60.98	63.39	64.34	66.43
1975	21.16	63.60	64.76	67.07	67.93
Region 2					
1940	14.06	47.54	55.04	50.16	57.31
1945	15.07	49.61	56.34	52.42	58.79
1950	16.26	51.87	57.88	54.88	60.50
1955	17.53	54.26	59.54	57.46	62.31
1960	18.80	56.70	61.23	60.08	64.15
1965	19.60	58.83	62.41	62.26	65.39
1970	20.21	60.90	63.34	64.26	66.38
1975	20.84	62.82	64.27	66.26	67.41
Region 3					
1940	16.11	52.14	57.78	55.16	60.39
1945	16.83	53.57	58.73	56.71	61.43
1950	17.73	55.21	59.91	58.47	62.72
1955	18.71	56.93	61.18	60.32	64.09
1960	19.67	58.72	62.46	62.18	65.46
1965	20.23	60.42	63.31	63.80	66.35
1970	20.68	61.99	64.00	65.41	67.11
1975	21.16	63.59	64.75	67.06	67.93

TABLE 36 (continued)

Year	West Mortality Level	Male e_0	Male e_5	Female e_0	Female e_5
Region 4					
1940	13.93	47.24	54.86	49.85	57.12
1945	14.67	48.73	55.82	51.46	58.20
1950	15.59	50.37	56.97	53.26	59.48
1955	16.56	52.09	58.21	55.13	60.86
1960	17.53	53.84	59.47	57.03	62.24
1965	18.23	55.65	60.48	58.96	63.34
1970	18.92	57.72	61.52	61.15	64.46
1975	19.77	60.35	62.80	63.66	65.79
Region 5					
1940	9.89	37.90	48.93	39.99	50.86
1945	10.32	38.74	49.55	40.91	51.53
1950	10.86	39.69	50.30	41.92	52.33
1955	11.45	40.69	51.10	42.99	53.19
1960	12.03	41.68	51.88	44.04	54.02
1965	12.66	43.30	52.87	45.74	55.06
1970	13.71	46.05	54.43	48.61	56.67
1975	14.75	48.72	55.89	51.46	58.28
Region 6					
1940	--	--	--	--	--
1945	--	--	--	--	--
1950	--	--	--	--	--
1955	--	--	--	--	--
1960	17.20	53.11	59.01	56.24	61.74
1965	18.77	56.87	61.24	60.26	64.16
1970	19.79	59.93	62.77	63.27	65.76
1975	20.82	62.78	64.24	66.22	67.38
Region 7					
1940	13.43	46.11	54.17	48.68	56.43
1945	14.37	48.06	55.42	50.73	57.75
1950	15.48	50.14	56.83	53.01	59.33
1955	16.67	52.33	58.35	55.38	61.02
1960	17.85	54.56	59.91	57.80	62.72
1965	18.84	57.03	61.34	60.43	64.26
1970	19.21	58.47	61.94	61.86	64.90
1975	19.64	60.06	62.62	63.36	65.61

this way for selected years. The "West" mortality levels used in deriving the adult portion of each life table are also displayed. As stated above, the same levels were used for males and females. The corresponding levels for children can be found in Table 20. The Appendix presents abridged life tables for Brazil as a whole for the years 1940, 1950, 1960, 1970, and 1975.

No reliable evidence could be found regarding adult mortality differentials between regions. However, regional adult mortality estimates are needed in order to apply the own-children method (used to estimate fertility in the next section). Therefore, with this need in mind, regional life tables were generated by assuming that the regional differentials in child mortality already estimated (see Table 20) are good indicators of regional differentials in adult mortality. Working under this assumption, the adult mortality levels estimated for Brazil as a whole were prorated for each region according to the ratio of the regional estimate of child mortality to the corresponding one for the country as a whole. The resulting adult mortality estimates in terms of "West" levels are shown in Table 36, accompanied by the estimated e_0 and e_5 values by sex. Although most of the estimates obtained by this process seem acceptable, no claim can be made about their accuracy. The paucity of data allowing the estimation of regional mortality precludes the derivation of better estimates.

CONCLUSION

This chapter presents estimates of child and adult mortality for Brazil as a whole and for each of the PNAD regions. The estimation of child mortality by region was possible from data that do reflect regional differentials. In contrast, adult mortality by region could not be estimated from data reflecting such differentials and had to be extrapolated by reference to child mortality. Therefore, the regional estimates of adult mortality presented here are somewhat weak and should be interpreted with caution.

The estimates for the country as a whole (summarized in Tables 20 and 36) suggest that mortality declined by gaining about six mortality levels in 35 years. In terms of expectation of life at birth, this decline translates into a gain of approximately 14 years for males and 15 years for females, that is, e_0 increased at an annual rate of approximately 0.4 years during the 1940-75

period. The gains have been equally impressive above age 5 as below age 5, but they still leave Brazil with an expectation of life in 1975 of about 60 years, suggesting that there is room for further improvement.

The mortality differentials by region revealed by the data on child mortality indicate that about 30 percent of Brazil's population (the inhabitants of Region 5, the Northeast) is still subject to very high mortality levels (implying an e_0 of only 50 years in 1975). If adult mortality is as high as the child mortality estimates suggest, the need for better health care and other related services is clear.

NOTE

1 According to census counts, the "foreign" population in Brazil (consisting of foreigners plus naturalized Brazilians) has evolved in the following manner: 1,407,000 in 1940; 1,214,000 in 1950; 1,400,000 in 1960; and 1,229,000 in 1970. By using estimates of mortality believed to be adequate for each intercensal period, it can be shown that the change in the foreign population between 1940 and 1950, and especially between 1960 and 1970, can be mostly be accounted for by mortality. For the 1950-60 period the expected number of foreigners obtained by projecting the 1950 figure to 1960 falls below the number enumerated in 1960 by some 361,000 persons (200,000 males and 161,000 females). This discrepancy may be due to an actual increase in the rate of net migration of foreigners to Brazil during the 1950-60 decade or to differential coverage of the foreign population by these censuses. However, even assuming that it is wholly due to net migration, the estimated excess number of foreigners in 1960 implies an annual immigration rate of only 0.0005, and this rate does not take into account the emigration of Brazilians, a flow that is considerably more difficult to measure. To give some idea of its magnitude we note that according to the 1960 round of censuses there were approximately 62,400 Brazilians living abroad (in Argentina, Colombia, Venezuela, Chile, Portugal, the United Kingdom, and West Germany. The 1960 tabulations for the United States and Canada do not distinguish Brazilians from other nationalities). By 1970, according to the censuses of countries that list Brazilians as a separate category (Argentina, Chile, Venezuela, the United States, and Canada), the number abroad was at least 77,500.

CHAPTER 3

FERTILITY

ESTIMATING FERTILITY

All the sources of demographic data in Brazil contain information about the fertility of its population. Every census since 1940 has included a question on children ever born, but only the two most recent ones (1970 and 1980) have also included questions on the occurrence of births during the year preceding the census (see Table 7). In addition, probabilistic samples of the households enumerated during the 1960 and 1970 censuses are available in machine-readable form, thus allowing detailed exploitation of the data. Questions on children ever born and on births during the year preceding interview have also been included in all the PNAD surveys, as well as in the ENDEF. Of these surveys, the one carried out in 1976 (being part of the PNAD series) is also available in machine-readable form. Finally, there is the vital registration system, which traditionally has recorded births as they occur. However, the lack of continuity in the data published by this system and the serious deficiencies evident in those which are available make them unsuitable as a basis for fertility estimation.

The types of data available determine the estimation methods that may be used. Data on children ever born gathered by censuses or surveys taken five or ten years apart have been used to estimate intercensal or inter-survey fertility rates. Because the change in average parity of a given group of women from one point in time to the next is directly related to the fertility rates prevalent during the intervening period, increments in the recorded average parity of women in the usual five-year age groups have been used to infer the fertility rates to which they have been subject (Arretx, 1973).

Problems arise, however, when the reported parities are affected by reporting errors. If, as is frequently the case, older women have a greater tendency to omit children ever born than do younger ones, the estimated parity increments will be too small and fertility will be underestimated. In the case of Brazil, the possibility of this error is aggravated by the fact that in the 1950 and 1960 censuses the question used to determine the number of children a woman had ever borne explicitly stated that stillbirths should be included in the count. As explained in the chapter on mortality, the raw data on this topic must be adjusted for the inclusion of stillbirths before any estimation method is applied. Under these circumstances, it is not surprising to find that the intercensal method of fertility estimation based solely on reported parities performs rather poorly for periods before 1970, and its results are not presented in this report.

Another method that has been fairly successful in estimating fertility in cases where its levels have remained more or less constant for some time is that proposed by Brass (1964). This method requires that two independent pieces of information on fertility be available: one referring to the long-term, cumulative experience of women subject to the risk of childbearing, and a second one referring to current fertility experience. The first is usually obtained from parity reports, while the second is derived from information about the occurrence of births during the year preceding interview ("births last year"). In the case of Brazil these two types of information are available from the 1970 census and from all the PNAD surveys. For earlier censuses, however, information on births that occurred during the year preceding the time of enumeration is missing. In those instances, the Brass procedure has been used to explore the consistency between reported parities (adjusted for the inclusion of stillbirths) and the shape of the "current" fertility schedules derived from the 1970 data. Such comparisons are enlightening and useful in establishing the level of fertility prevalent in Brazil before 1970.

Finally, the last method to be used in estimating fertility is the own-children method proposed by Cho (1973). The types of information it requires are the number of children (persons under 15) in the population, classified by single years of own age and single years of age of mother, and the total number of females aged 15 to 64, classified by single years of age. Such information

usually can be derived from the data gathered by censuses or by demographic surveys, although the derivation is generally not straightforward. Problems arise because, although censuses and surveys always record the age of each member of the household, only rarely do they directly link each woman with her children when the children still live in the same household as she does. Information on the relationship of each household member to the head of the household usually makes it possible to establish with near certainty who the mother of each enumerated child is. This linking process is generally carried out by computer, and although it is not entirely foolproof, the results it yields are satisfactory. In addition, growing awareness of the importance of an accurate mother-child linkage has prompted the organizers of recent surveys to perform it directly in the field by posing the appropriate questions at the time of interview. In Brazil this procedure was followed in the 1976 PNAD, for which the "own-children" data can be obtained with relative ease. For previous years, the availability of machine-readable census samples for 1960 and 1970 makes possible the computer matching of mothers and children and the derivation of the data required for the application of this method.

The next two sections of this chapter, which present the results yielded by the two main methods of analysis used, are followed by a comparison of the preliminary estimates obtained. The concluding section presents the final set of estimates selected. Its implications in terms of population growth are presented in the concluding chapter.

The Brass Estimation Procedure

The Brass estimation procedure, also known as the P/F ratio method, is described in detail in UN Manual X (United Nations, 1982). It consists of comparing the lifetime cumulative fertility of women (as measured by the parities P they report at the time of interview) with the fertility that can be inferred from their most recent fertility experience (denoted by F and measured in terms of births occurring during the year preceding interview). If fertility had remained constant throughout their lifetimes and reporting were completely accurate, the two measures, the cumulative P and the current F, should be identical and all P/F ratios should equal one. In less ideal circumstances, even though fertility has been more

or less constant but reporting is inaccurate, experience has shown that the typical reporting errors tend to have two main effects: they distort the level of current fertility but not its shape and they affect mostly the cumulative reports of older women rather than those of younger ones. These typical patterns of error justify Brass's suggestion of using the values of the P/F ratios observed among younger women (those aged 20-24, 25-29, and even 30-34) to adjust the level of current fertility and thus obtain a more accurate estimate.

The use of this method of adjustment is more difficult to justify in cases where fertility has not remained constant. In principle, the comparison of current and cumulated fertility is still valid, and indeed it can provide valuable insight about the changes fertility has undergone in the past, but when it is certain that fertility has changed no solid basis exists for selecting one adjustment factor over another. Nevertheless, in the analysis that follows, a series of adjustment factors will be selected and their acceptability will be assessed in later sections with reference to other evidence.

The 1950 and 1960 Censuses

Application of the Brass P/F ratio method to the 1950 and 1960 census data must be treated separately because, as explained above, these data are both incomplete and flawed. They are incomplete for the purposes of fertility estimation because no information is available on births occurring during the year preceding each census. They are flawed because the information on children ever born recorded by these two censuses includes stillbirths, that is, cases of children born dead which, in demography, are traditionally excluded from the definition of a woman's parity. This flaw is perhaps of greater relevance when the data are used to estimate child mortality than when they are used to estimate fertility. However, in both cases the bias inherent to the basic data cannot be ignored. The previous chapter described the procedure used to adjust the parity information derived from the 1950 and 1960 censuses (see discussion of Figure 3). The adjusted parities for Brazil and its seven regions from 1950 to 1977 are presented in Table 37.

Examination of the parities displayed in this table reveals several interesting traits of the basic data. For the country as a whole, average parities for older

TABLE 37 Reported Parities, 1950-77: Brazil and Regions

Age Group	Reported Parities							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 1: Brazil								
15-19	0.14	0.12	0.12	0.12	0.11	0.11	0.12	0.11
20-24	1.06	1.07	0.97	0.93	0.91	0.84	0.82	0.84
25-29	2.43	2.47	2.43	2.38	2.27	2.26	2.04	2.02
30-34	3.74	3.69	3.78	3.74	3.73	3.80	3.40	3.37
35-39	4.86	4.74	4.80	4.81	4.86	5.12	4.51	4.53
40-44	5.53	5.33	5.31	5.47	5.58	5.92	5.19	5.20
45-49	5.93	5.60	5.52	5.80	5.83	6.05	5.57	5.58
Part 2: Region 1								
15-19	0.12	0.09	0.09	0.11	0.10	0.10	0.10	0.09
20-24	0.84	0.87	0.73	0.73	0.70	0.66	0.62	0.64
25-29	1.81	1.92	1.85	1.79	1.77	1.62	1.59	1.55
30-34	2.68	2.75	2.86	2.84	2.70	2.91	2.56	2.52
35-39	3.42	3.32	3.58	3.59	3.65	3.70	3.19	3.25
40-44	3.97	3.69	3.91	3.85	3.99	4.26	3.80	3.62
45-49	4.37	3.88	3.98	4.06	4.19	4.47	3.82	3.84
Part 3: Region 2								
15-19	0.11	0.11	0.09	0.10	0.10	0.09	0.10	0.10
20-24	0.91	0.95	0.77	0.74	0.70	0.66	0.68	0.70
25-29	2.10	2.08	1.97	1.88	1.84	1.74	1.65	1.65
30-34	3.22	2.96	2.99	2.83	2.86	2.92	2.64	2.59
35-39	4.19	3.78	3.73	3.79	3.66	4.09	3.35	3.61
40-44	4.95	4.31	4.09	4.15	4.41	4.66	4.06	4.07
45-49	5.52	4.61	4.37	4.41	4.39	4.75	4.23	4.32
Part 4: Region 3								
15-19	0.15	0.12	0.13	0.11	0.10	0.10	0.10	0.10
20-24	1.07	1.10	1.02	0.95	0.93	0.85	0.81	0.85
25-29	2.39	2.49	2.45	2.39	2.19	2.27	2.00	1.97
30-34	3.67	3.67	3.76	3.68	3.63	3.61	3.28	3.33
35-39	4.78	4.71	4.75	4.78	4.80	4.86	4.42	4.36
40-44	5.52	5.38	5.30	5.49	5.37	5.69	4.99	5.22
45-49	5.96	5.65	5.54	5.73	5.79	5.98	5.64	5.64

TABLE 37 (continued)

Age Group	Reported Parities							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 5: Region 4								
15-19	0.13	0.11	0.09	0.09	0.07	0.08	0.08	0.07
20-24	1.08	1.10	0.90	0.82	0.80	0.76	0.72	0.72
25-29	2.56	2.62	2.43	2.32	2.13	2.22	1.97	1.85
30-34	3.98	3.97	3.99	3.89	3.87	3.92	3.39	3.31
35-39	5.27	5.14	5.20	5.25	5.30	5.43	4.87	4.65
40-44	6.04	5.79	5.82	5.96	5.97	6.67	5.80	5.53
45-49	6.52	6.19	6.08	6.38	6.59	6.99	6.12	6.03
Part 6: Region 5								
15-19	0.15	0.13	0.13	0.16	0.14	0.16	0.15	0.15
20-24	1.14	1.11	1.11	1.15	1.15	1.07	1.06	1.06
25-29	2.67	2.73	2.80	2.95	2.85	2.89	2.57	2.61
30-34	4.21	4.32	4.46	4.73	4.78	4.90	4.39	4.37
35-39	5.46	5.57	5.76	5.95	6.08	6.36	5.79	5.85
40-44	6.09	6.19	6.44	6.98	7.14	7.39	6.58	6.67
45-49	6.42	6.45	6.61	7.40	7.32	7.34	7.17	7.14
Part 7: Region 6								
15-19	--	0.21	0.13	0.12	0.11	0.10	0.09	0.11
20-24	--	1.21	0.98	0.84	0.84	0.91	0.77	0.72
25-29	--	2.43	2.30	2.16	2.14	2.37	1.83	1.75
30-34	--	3.15	3.52	3.46	3.40	3.95	3.22	2.89
35-39	--	4.16	4.48	4.31	4.22	5.39	4.08	3.86
40-44	--	4.67	5.14	5.05	4.82	6.45	5.06	4.46
45-49	--	5.24	5.45	5.48	5.33	6.31	5.50	4.99
Part 8: Region 7								
15-19	0.21	0.17	0.18	--	--	--	--	--
20-24	1.27	1.30	1.26	--	--	--	--	--
25-29	2.69	2.84	2.91	--	--	--	--	--
30-34	3.92	4.17	4.40	--	--	--	--	--
35-39	4.97	5.22	5.57	--	--	--	--	--
40-44	5.49	5.74	6.11	--	--	--	--	--
45-49	5.78	5.97	6.23	--	--	--	--	--

TABLE 37 (continued)

Age Group	Reported Parities							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 9: Region 7, Urban Areas								
15-19	0.15	--	0.12	--	0.11	--	0.15	0.16
20-24	0.98	--	0.98	--	0.98	--	0.91	0.98
25-29	2.14	--	2.50	--	2.39	--	2.25	2.28
30-34	3.22	--	4.02	--	3.95	--	3.68	3.63
35-39	4.14	--	5.11	--	5.06	--	4.83	4.73
40-44	4.62	--	5.68	--	5.62	--	5.50	5.51
45-49	4.91	--	5.79	--	6.43	--	5.75	5.79
Part 10: Region 7, Rural Areas								
15-19	0.23	--	0.24	--	--	--	--	--
20-24	1.41	--	1.53	--	--	--	--	--
25-29	2.93	--	3.26	--	--	--	--	--
30-34	4.25	--	4.75	--	--	--	--	--
35-39	5.37	--	6.00	--	--	--	--	--
40-44	5.92	--	6.54	--	--	--	--	--
45-49	6.23	--	6.64	--	--	--	--	--

--: not available.

[a]Parities have been adjusted for the inclusion of stillbirths.

women (35 and over) according to the 1960 census are very similar to those recorded by the 1970 census; the equivalent average parities for 1950 are consistently higher. In addition, parities for women over 40 recorded by the early PNADs (1972 and 1973) are even higher than those recorded by the 1970 census, in spite of the fact that these PNADs do not include the rural part of Region 7, which appears to have higher-than-average fertility levels. These observations suggest that the parities of older women (35 and over) tend to be underreported in the censuses and that the degree of underreporting did not remain constant from one census to the next. In particular, the parities of older women according to the 1960 and even the 1970 censuses seem to be less accurate than those estimated for 1950 on the basis of the adjustment for the inclusion of stillbirths. It is this trait

of the data (changes in the completeness of parity reporting through time) that invalidates the use of intercensal fertility estimation techniques in Brazil for periods prior to 1970. The biases noticed at the national level are also evident at the regional level, although the data for some regions are slightly better than those for others.

Another characteristic that must be noted is the marked regional variation in fertility that the parity reports reveal. Even as early as 1950, Region 1 (Rio de Janeiro, the site of Brazil's former capital city, and Guanabara) exhibited a fertility level approximately 25 percent below the national average, and as of 1960 both Regions 1 and 2 exhibited fertility levels significantly lower than those for the country as a whole. In contrast, Region 5 has been traditionally a high-fertility area, whose data also appear to be subject to greater biases than those affecting data of the more advanced Regions 1 and 2.

Normally, the lack of information on current fertility (births during the year preceding enumeration) would entirely preclude the use of the Brass procedure for fertility estimation. However, as Carvalho (1974) suggested, it is possible to use the current fertility information gathered by the 1970 census to generate age-specific fertility schedules that can be compared to the average parities reported in 1950 and 1960 via the P/F ratio method. The use of the 1970 data would be justified if the pattern of age-specific fertility had remained constant between 1950 or thereabouts and 1970. Since not enough evidence is available at this stage of the analysis to sustain this hypothesis, we will consider it valid for the moment and evaluate its implications later.

Table 38 presents the 1950 and 1960 fertility schedules derived from the 1970 data and reflecting the total fertility level reported by older women (45-49) at the corresponding census dates (1950 and 1960). As the table indicates, the shape of the age-specific fertility schedules has been adjusted by taking into account the fact that women who reported having had a child during the year preceding the 1970 census reported their age as of the time of enumeration rather than as of the date at which they gave birth. Therefore, on average, they were half-a-year younger at the time of the birth than at the time of enumeration. The adjustment used to derive the schedules presented in Table 38 reduces the effect of this "half-a-year age shift" (see U.N. Manual X, United

TABLE 38 Age-Specific Fertility Rates Adjusted for Half-a-Year Age Shift, 1950-77: Brazil and Regions

Age Group	Fertility Schedules Adjusted for Half-a-Year Age Shift							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 1: Brazil								
15-19	0.077	0.072	0.057	0.053	0.062	0.064	0.060	0.062
20-24	0.261	0.246	0.194	0.176	0.192	0.192	0.169	0.180
25-29	0.302	0.285	0.224	0.207	0.213	0.217	0.184	0.191
30-34	0.251	0.237	0.186	0.172	0.171	0.179	0.154	0.154
35-39	0.186	0.175	0.138	0.122	0.119	0.127	0.106	0.105
40-44	0.087	0.082	0.065	0.056	0.055	0.057	0.048	0.044
45-49	0.023	0.022	0.017	0.011	0.008	0.008	0.009	0.009
TF	5.935	5.597	4.403	3.981	4.101	4.220	3.649	3.724
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Part 2: Region 1								
15-19	0.067	0.059	0.045	0.044	0.052	0.052	0.052	0.044
20-24	0.215	0.191	0.145	0.132	0.148	0.152	0.135	0.137
25-29	0.239	0.212	0.161	0.154	0.149	0.151	0.144	0.150
30-34	0.171	0.151	0.115	0.106	0.108	0.106	0.098	0.111
35-39	0.118	0.104	0.079	0.066	0.078	0.073	0.053	0.060
40-44	0.052	0.046	0.035	0.022	0.024	0.020	0.021	0.025
45-49	0.013	0.012	0.009	0.004	0.004	0.000	0.005	0.003
TF	4.375	3.880	2.944	2.640	2.816	2.763	2.542	2.646
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Part 3: Region 2								
15-19	0.084	0.070	0.048	0.046	0.057	0.056	0.057	0.060
20-24	0.281	0.234	0.161	0.137	0.162	0.159	0.148	0.166
25-29	0.303	0.253	0.174	0.157	0.179	0.174	0.152	0.153
30-34	0.217	0.181	0.124	0.110	0.121	0.124	0.110	0.111
35-39	0.146	0.122	0.084	0.071	0.062	0.071	0.064	0.061
40-44	0.060	0.050	0.034	0.029	0.035	0.035	0.034	0.021
45-49	0.015	0.012	0.008	0.008	0.004	0.008	0.002	0.007
TF	5.524	4.611	3.163	2.781	3.096	3.133	2.835	2.889
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

TABLE 38 (continued)

Age Group	Fertility Schedules Adjusted for Half-a-Year Age Shift							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 4: Region 3								
15-19	0.089	0.085	0.064	0.052	0.065	0.063	0.054	0.058
20-24	0.282	0.267	0.202	0.178	0.187	0.196	0.154	0.175
25-29	0.296	0.281	0.212	0.187	0.190	0.206	0.163	0.166
30-34	0.237	0.225	0.170	0.145	0.149	0.159	0.133	0.120
35-39	0.178	0.169	0.128	0.107	0.117	0.097	0.086	0.084
40-44	0.088	0.083	0.063	0.053	0.049	0.057	0.036	0.038
45-49	0.021	0.020	0.015	0.018	0.007	0.007	0.008	0.006
TF	5.955	5.647	4.263	3.694	3.815	3.920	3.173	3.236
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Part 5: Region 4								
15-19	0.064	0.061	0.045	0.042	0.045	0.045	0.045	0.041
20-24	0.267	0.253	0.186	0.164	0.171	0.160	0.160	0.160
25-29	0.327	0.311	0.229	0.194	0.196	0.207	0.185	0.185
30-34	0.287	0.272	0.200	0.183	0.179	0.171	0.148	0.156
35-39	0.223	0.212	0.156	0.143	0.130	0.143	0.121	0.105
40-44	0.109	0.103	0.076	0.077	0.064	0.068	0.054	0.048
45-49	0.028	0.027	0.020	0.013	0.006	0.020	0.012	0.016
TF	6.517	6.191	4.555	4.081	3.955	4.062	3.623	3.547
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Part 6: Region 5								
15-19	0.070	0.070	0.061	0.066	0.073	0.085	0.075	0.077
20-24	0.251	0.252	0.218	0.221	0.239	0.247	0.211	0.221
25-29	0.316	0.318	0.275	0.278	0.281	0.285	0.237	0.256
30-34	0.290	0.291	0.252	0.255	0.246	0.272	0.232	0.231
35-39	0.221	0.222	0.192	0.186	0.175	0.199	0.167	0.177
40-44	0.106	0.107	0.092	0.085	0.084	0.089	0.080	0.076
45-49	0.030	0.030	0.026	0.013	0.015	0.010	0.016	0.012
TF	6.418	6.449	5.584	5.516	5.566	5.928	5.096	5.243
Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

TABLE 38 (continued)

Age Group	Fertility Schedules Adjusted for Half-a-Year Age Shift							
	1950[a]	1960[a]	1970	1972	1973	1974	1976	1977
Part 7: Region 6								
15-19	--	0.073	0.061	0.039	0.062	0.060	0.050	0.054
20-24	--	0.234	0.195	0.151	0.178	0.183	0.172	0.175
25-29	--	0.266	0.222	0.169	0.190	0.225	0.177	0.200
30-34	--	0.218	0.182	0.119	0.148	0.153	0.131	0.142
35-39	--	0.157	0.131	0.093	0.098	0.128	0.078	0.094
40-44	--	0.073	0.061	0.032	0.033	0.047	0.041	0.030
45-49	--	0.027	0.022	0.019	0.005	0.001	0.005	0.007
TF	--	5.244	4.365	3.099	3.572	3.992	3.271	3.507
Adjustment Factor	--	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Part 8: Region 7								
15-19	0.085	0.087	0.080	--	--	--	--	--
20-24	0.247	0.255	0.234	--	--	--	--	--
25-29	0.282	0.291	0.267	--	--	--	--	--
30-34	0.241	0.248	0.228	--	--	--	--	--
35-39	0.186	0.192	0.176	--	--	--	--	--
40-44	0.090	0.093	0.086	--	--	--	--	--
45-49	0.027	0.027	0.025	--	--	--	--	--
TF	5.781	5.968	5.486	--	--	--	--	--
Adjustment Factor	1.000	1.000	1.000	--	--	--	--	--
Part 9: Region 7, Urban Areas								
15-19	0.064	--	0.057	--	0.071	--	0.065	0.086
20-24	0.211	--	0.187	--	0.200	--	0.181	0.186
25-29	0.253	--	0.224	--	0.214	--	0.187	0.207
30-34	0.207	--	0.184	--	0.173	--	0.125	0.144
35-39	0.156	--	0.139	--	0.121	--	0.099	0.094
40-44	0.072	--	0.064	--	0.050	--	0.044	0.044
45-49	0.019	--	0.017	--	0.012	--	0.008	0.006
TF	4.910	--	4.359	--	4.205	--	3.540	3.829
Adjustment Factor	1.000	--	1.000	--	1.000	--	1.000	1.000

TABLE 38 (continued)

Age Group	Fertility Schedules Adjusted for Half-a-Year Age Shift							
	1950[a]	1960	1970	1972	1973	1974	1976	1977
Part 10: Region 7, Rural Areas								
15-19	0.098	--	0.103	--	--	--	--	--
20-24	0.265	--	0.278	--	--	--	--	--
25-29	0.291	--	0.305	--	--	--	--	--
30-34	0.256	--	0.269	--	--	--	--	--
35-39	0.202	--	0.211	--	--	--	--	--
40-44	0.103	--	0.107	--	--	--	--	--
45-49	0.031	--	0.033	--	--	--	--	--
TF	6.230	--	6.526	--	--	--	--	--
Adjustment Factor	1.000	--	1.000	--	--	--	--	--

--: not available.

[a]Derived from the 1970 census.

Nations, 1983). However, this adjustment does not alter the level of the observed fertility schedules. This fact is indicated in Table 38 by showing that all adjustment factors equal one.

Table 39 presents the results obtained by comparing the average parities of Table 37 (P) with those generated on the basis of the fertility schedules of Table 38 (F). The P/F ratios listed in columns 2 and 3 of Table 39 are all constrained to be one (or approximately so) for age group 45-49 because of the way in which the 1950 and 1960 fertility schedules of Table 38 were constructed. Therefore, only the trend of the P/F ratios for age groups below 45-49 is indicative of inconsistencies between the estimated current fertility schedule and the reported average parities.

For the country as a whole, the P/F ratios for 1950 are fairly close to one and display the trend one would expect if parities tended to be underreported by older women (roughly, they decline as age increases). A similar trend is observed in 1960, but in this instance the P/F ratios deviate somewhat more from one, especially at ages 20-24 and 25-29. Thus, if only these age groups were considered in selecting an adjustment factor for current fertility, the factor for 1960 would be greater than that for 1950, implying that the consistency of the 1960 data

TABLE 39 Estimated P/F Ratios, 1950-77: Brazil and Regions

Age Group	Estimated P/F Ratios							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 1: Brazil								
15-19	1.12	1.03	1.28	1.39	1.07	1.03	1.12	1.10
20-24	1.07	1.14	1.32	1.38	1.19	1.09	1.17	1.14
25-29	0.99	1.07	1.33	1.43	1.26	1.24	1.27	1.20
30-34	0.97	1.02	1.32	1.43	1.34	1.34	1.38	1.31
35-39	0.98	1.02	1.31	1.43	1.39	1.42	1.45	1.41
40-44	0.99	1.01	1.28	1.44	1.41	1.46	1.48	1.45
45-49	1.01	1.01	1.26	1.46	1.43	1.44	1.53	1.50
TF	5.93[a]	5.60[a]	4.40	3.98	4.10	4.22	3.65	3.72
Part 2: Region 1								
15-19	1.06	0.96	1.25	1.45	1.12	1.18	1.08	1.21
20-24	1.01	1.17	1.30	1.42	1.14	1.07	1.08	1.19
25-29	0.89	1.07	1.35	1.40	1.28	1.15	1.21	1.21
30-34	0.88	1.02	1.39	1.47	1.34	1.42	1.33	1.29
35-39	0.91	0.99	1.41	1.52	1.46	1.48	1.39	1.37
40-44	0.95	0.99	1.39	1.50	1.45	1.56	1.54	1.40
45-49	1.00	1.00	1.36	1.54	1.49	1.62	1.51	1.45
TF	4.37[a]	3.88[a]	2.94	2.64	2.82	2.76	2.54	2.65
Part 3: Region 2								
15-19	0.82	0.96	1.20	1.28	1.04	0.95	1.06	1.03
20-24	0.85	1.06	1.25	1.38	1.08	1.01	1.07	1.00
25-29	0.81	0.96	1.32	1.42	1.18	1.14	1.17	1.08
30-34	0.83	0.91	1.34	1.42	1.23	1.28	1.27	1.18
35-39	0.87	0.94	1.35	1.55	1.33	1.49	1.34	1.38
40-44	0.93	0.97	1.35	1.55	1.46	1.55	1.47	1.45
45-49	1.00	1.00	1.39	1.59	1.42	1.52	1.49	1.50
TF	5.52[a]	4.61[a]	3.16	2.78	3.10	3.13	2.84	2.89

TABLE 39 (continued)

Age Group	Estimated P/F Ratios							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 4: Region 3								
15-19	1.01	0.87	1.21	1.39	0.92	0.97	1.10	1.08
20-24	0.95	1.03	1.26	1.38	1.19	1.10	1.27	1.19
25-29	0.92	1.01	1.31	1.47	1.25	1.25	1.38	1.24
30-34	0.93	0.98	1.33	1.50	1.40	1.31	1.48	1.44
35-39	0.96	1.00	1.33	1.55	1.47	1.45	1.60	1.55
40-44	0.98	1.01	1.31	1.59	1.46	1.51	1.64	1.67
45-49	1.01	1.01	1.31	1.56	1.52	1.53	1.78	1.75
TF	5.96[a]	5.65[a]	4.27	3.69	3.82	3.92	3.17	3.24
Part 5: Region 4								
15-19	1.34	1.17	1.31	1.33	1.06	1.05	1.13	1.15
20-24	1.15	1.23	1.37	1.37	1.26	1.31	1.19	1.24
25-29	1.04	1.11	1.41	1.54	1.36	1.44	1.31	1.26
30-34	0.99	1.04	1.42	1.58	1.53	1.58	1.46	1.42
35-39	0.99	1.02	1.40	1.60	1.61	1.65	1.61	1.56
40-44	0.99	1.00	1.36	1.55	1.57	1.76	1.69	1.65
45-49	1.01	1.01	1.34	1.57	1.67	1.73	1.70	1.71
TF	6.52[a]	6.19[a]	4.55	4.08	3.96	4.06	3.62	3.55
Part 6: Region 5								
15-19	1.32	1.13	1.35	1.43	1.18	1.06	1.12	1.14
20-24	1.23	1.19	1.37	1.38	1.25	1.06	1.20	1.17
25-29	1.12	1.14	1.35	1.39	1.26	1.23	1.28	1.23
30-34	1.07	1.10	1.30	1.36	1.33	1.30	1.36	1.30
35-39	1.05	1.06	1.27	1.30	1.31	1.28	1.37	1.33
40-44	1.02	1.03	1.23	1.32	1.35	1.29	1.36	1.33
45-49	1.01	1.01	1.19	1.35	1.32	1.24	1.41	1.37
TF	6.42[a]	6.45[a]	5.58	5.52	5.57	5.93	5.10	5.24

TABLE 39 (continued)

Age Group	Estimated P/F Ratios							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 7: Region 6								
15-19	--	1.75	1.25	2.11	1.06	1.04	1.22	1.19
20-24	--	1.32	1.28	1.55	1.15	1.28	1.17	1.08
25-29	--	1.10	1.25	1.55	1.27	1.31	1.17	1.05
30-34	--	0.92	1.23	1.65	1.34	1.45	1.37	1.15
35-39	--	0.95	1.23	1.63	1.33	1.56	1.43	1.24
40-44	--	0.95	1.26	1.74	1.39	1.65	1.60	1.31
45-49	--	1.01	1.26	1.78	1.50	1.58	1.69	1.43
TF	--	5.24[a]	4.36	3.10	3.57	3.99	3.27	3.51
Part 8: Region 7								
15-19	1.41	1.13	1.32	--	--	--	--	--
20-24	1.27	1.25	1.32	--	--	--	--	--
25-29	1.13	1.16	1.29	--	--	--	--	--
30-34	1.07	1.10	1.26	--	--	--	--	--
35-39	1.04	1.06	1.23	--	--	--	--	--
40-44	1.01	1.03	1.19	--	--	--	--	--
45-49	1.01	1.01	1.14	--	--	--	--	--
TF	5.78[a]	5.97[a]	5.49	--	--	--	--	--

TABLE 39 (continued)

Age Group	Estimated P/F Ratios							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 9: Region 7, Urban Areas								
15-19	1.36	--	1.29	--	0.92	--	1.34	1.00
20-24	1.20	--	1.36	--	1.18	--	1.21	1.14
25-29	1.06	--	1.40	--	1.25	--	1.31	1.20
30-34	1.02	--	1.43	--	1.37	--	1.48	1.31
35-39	1.01	--	1.41	--	1.40	--	1.58	1.41
40-44	1.00	--	1.38	--	1.40	--	1.61	1.48
45-49	1.01	--	1.34	--	1.54	--	1.63	1.52
TF	4.91[a]	--	4.36	--	4.21	--	3.54	3.83
Part 10: Region 7, Rural Areas								
15-19	1.35	--	1.33	--	--	--	--	
20-24	1.25	--	1.29	--	--	--	--	
25-29	1.15	--	1.22	--	--	--	--	
30-34	1.08	--	1.15	--	--	--	--	
35-39	1.06	--	1.13	--	--	--	--	
40-44	1.02	--	1.07	--	--	--	--	
45-49	1.01	--	1.02	--	--	--	--	
TF	6.23[a]	--	6.53	--	--	--	--	

--: not available.

[a]Average parity of women aged 45-49.

with estimated current fertility is less than that of the 1950 data with essentially the same type of fertility schedule.

At the regional level, discrepancies between the observed P's and the estimated F's tend to be even more marked, and it is not always easy to interpret the trends displayed by the P/F ratios with respect to age. For example, for Region 1, the 1950 P/F ratios display almost a U-shaped pattern, indicating that the shape of the 1970 fertility schedule is not consistent with the average parities reported in 1950. However, it is interesting to note that the typical pattern of the P/F ratios when fertility is declining (increasing with age) is not evident in this case.

In contrast, the 1950 P/F ratios for Region 5 (the Northeast) display the typical declining trend that is expected when fertility has been constant and average parity is underreported by older women. The 1960 P/F ratios for this region also display an acceptable trend and both sets suggest that both in 1950 and in 1960 older women grossly underreported their parities (by as much as 16 or 17 percent, perhaps).

These detailed comparisons suggest that, although the discrepancies between P's and F's are relatively small for the country as a whole, they result from far greater ones at the regional level, whose opposing signs tend to cancel each other in the aggregate. As we shall see later, some kind of consistency at the regional level must be achieved before a trustworthy estimate for the country as a whole may be derived.

The 1970 Census and the PNAD Surveys

Tables 37 through 39 also present the basic data and the results obtained by applying the P/F ratio method (United Nations, 1983) to the 1970 census and to most of the surveys carried out during the 1970-80 decade (the 1972, 1973, 1976, and 1977 PNADs and the 1974 ENDEF). Notice that not all regions were covered by all the surveys. The 1972 PNAD did not include Region 7 and all the rest covered only its urban areas. In addition, the ENDEF data for urban Region 7 are not available. Hence, in deriving final estimates for the country as a whole some allowance will have to be made for the missing region which, fortunately, never amounts to more than 4 percent of the total population.

Some of the main characteristics of the basic data (Tables 37 and 38) have already been noted in the previous section. Of special importance is the fact that older women (those over 40) tend to report higher parities in the surveys than in the censuses, with the differences being substantial in certain regions (c.f. Region 5 and Region 7).

The age-specific fertility rates presented in Table 38 are accompanied by the total fertility rates (TF) they imply. These TF values are unadjusted, and their trend at both the country and the regional level is neither smooth nor monotone. Both increases and decreases from one period to the next are evident, although the overall tendency of total fertility is to fall. In general, the TF values produced by the 1973 PNAD are higher than those yielded by the 1972 PNAD, the 1974 ENDEF values are higher than those recorded in 1973, and those of 1977 are higher than those of 1976. However, given the statistical variability inherent in the results of any sample survey, it is likely that the size of the difference between these pairs of adjacent values is not significant.

Both the reported parities of Table 37 and the total fertility rates (TF) of Table 38 reveal the existence of substantial regional differentials with respect to fertility levels. However, these differentials are greater in magnitude when measured in terms of the average parities of older women than when assessed in terms of current, unadjusted, total fertility rates. To the extent that the latter are representative of the true fertility levels in the different regions, this observation suggests that the decline in fertility experienced by the Brazilian population has tended to reduce regional differences.

To assess the degree of consistency existing between recorded average parities and the reported current fertility schedules of Table 38, the P/F ratios implied by these two pieces of evidence have been calculated and are presented in Table 39. In ideal circumstances, when fertility has remained constant and there is no misreporting, the P/F ratios calculated from a given data set should be constant with respect to age. A decreasing trend with age is usually caused by parity understatement at older ages, while an increasing trend usually indicates the existence of a decline in fertility. Of course, the effects of decreasing fertility may interact with parity understatements to produce sets of P/F ratios that fail to decrease consistently as age increases or that do so more slowly than they would if fertility had remained

constant. In such cases the P/F ratio sequence may not provide conclusive evidence about the existence of a fertility decline.

In light of these general considerations about the meaning of P/F ratio sequences, it would appear that up to 1970 there is very little evidence substantiating a reduction in fertility for Brazil as a whole: if one disregards the P/F ratio for age group 15-19, the 1970 sequence seems fairly constant up to age group 35-39 and shows a moderate tendency to decline thereafter. Rejection of the first P/F ratio is usual, because the method traditionally employed to estimate parity-equivalents F from observed age-specific fertility rates is rather "rough" and cannot approximate adequately the sharp changes in fertility that take place within the youngest age group of the childbearing span. Recently, however, a more accurate approximation method has been developed (United Nations, 1982), and although the first P/F ratio is still not recommended as a basis for the adjustment of the observed age-specific fertility schedule (if only because it is generally based on very few cases), its reliability in establishing rough trends with respect to age has increased. Thus, accepting the first P/F ratio as valid, the 1970 sequence can be viewed in a different way: as showing a slight increase from 15-19 to 25-29, followed by a slight decline thereafter. The increase at younger ages may be indicative of recent fertility reductions, while the decline at older ones may be caused by the understatement of average parity even among rather young women (those aged 30-34). The likely existence of such bias has already been pointed out in comparing the average parities reported by the censuses with those reported by the household surveys, a fact that further substantiates this second interpretation of the 1970 P/F ratio sequence.

In addition, still speaking at the level of the country as a whole, the trend of the 1970 P/F ratios contrasts sharply with that displayed by the ratios corresponding to any of the household surveys conducted between 1972 and 1977. For these surveys, the P/F ratios increase consistently with age, indicating without doubt that a reduction in fertility has taken place. Because it is unlikely that such a process, so evidently apparent according to the 1972 data, may have started only after 1970, the misleading indications attributed at first to the 1970 P/F sequence must be rejected.

While the scope of this report does not allow a detailed analysis and interpretation of the observed P/F ratio sequences at the regional level, some important traits may be highlighted. First, in comparing the trend of the 1970 P/F ratios with the trends exhibited by the ratios estimated for later periods, it is evident that only the former display, if at all, a definitely declining trend at older ages (over 35). The only notable exception to this general observation is provided by Region 5, where even as late as 1974 the P/F ratios fail to display a consistently increasing trend. The frequently divergent behavior of Region 5 (the Northeast) is important because it comprises about 30 percent of Brazil's population, so its impact on the whole is substantial. In contrast, Region 6 (the Federal District) corresponds to at most 1.5 percent of the total population, so that its sometimes erratic estimates have a negligible influence on the national average.

Considering solely the regional estimates yielded by the 1970 census, only Region 2 displays a P/F sequence that increases consistently with age. It can be concluded therefore, that the data for all the other regions is affected by parity understatement. In particular, the fairly sharp decline exhibited by the 1970 P/F ratios of Regions 5 and 7 suggest that their data are subject to greater biases than those of other regions. It is probably because of those regions (5 and 7) that the P/F ratios at the national level fail to display an increasing trend with age.

Considering next, for each region, the P/F ratios for all periods, it can be concluded that Regions 1 and 2 (Rio de Janeiro and Sao Paulo) have experienced a long-term fertility decline that is evident even as early as 1970, if some allowance is made for a certain degree of parity understatement at older ages. Regions 3 and 4 are the "in between" cases where some decline is likely to have occurred prior to 1970, but where the effects of parity understatement have a confounding effect on the 1970 data. Regions 5 and 7 are those where a decline is unlikely to have occurred before 1973 (or even before 1974-75) and where the level of misreporting is probably the highest. Finally, Region 6 is a special case, whose data are subject to greater sampling variability than those for other regions and whose fertility levels are substantially influenced by the heavy immigration it has experienced during recent decades. Hence, although it is certain that its fertility levels have declined since it

became Federal District, it is more difficult to establish when the decline started.

The Selection of Adjustment Factors for Age-Specific Fertility During the 1950-77 Period

As mentioned earlier, when there is evidence suggesting the existence of a fertility decline, as is the case for Brazil and its regions, there are no guidelines to direct the choice of an adjustment factor for reported current fertility. Yet, at least two facts suggest that the reported age-specific fertility rates need to be adjusted in order to represent true fertility levels adequately: first, the trends through time of the unadjusted total fertility rates of Table 38 do not seem acceptable. Second, the overall magnitude of the P/F ratios for any one region changes substantially from survey to survey, suggesting that different surveys achieved different levels of completeness of reporting of recent births. In such circumstances, direct comparisons of the unadjusted rates is unwarranted and may be misleading. Therefore, adjustment becomes mandatory. Given the wealth of available data, and the lack of a sound theoretical basis on which to base the choice of adjustment factors, it is probably acceptable to adopt some expedient, even-handed method of adjustment that treats all the data equally. Using the mean of the P/F ratios corresponding to age groups 20-24, 25-29, and 30-34 as adjustment factor produces total fertility rates that, with very few exceptions, decline monotonically over time, so it was adopted as an acceptable adjusting scheme. Table 40 presents the adjusted age-specific fertility rates, the corresponding total fertility rates (TF), and the adjustment factors used.

Two additional comments must be made about the estimates in Table 40. First, given that fertility levels have been changing, they are not likely to refer exactly to the year preceding the survey because they result from the use of an adjustment factor based on the cumulated experience of women who have had most of their children during the 10 years or so preceding the survey. Hence, in later sections they will be assigned a reference period spanning several years in order to convey explicitly the uncertainty surrounding their true reference date. Second, the estimates of Table 40 are by no means definitive. Further analysis is necessary to validate them. They should be treated only as preliminary results.

TABLE 40 Age-Specific Fertility Schedules Adjusted by the Mean of the P/F Ratios Corresponding to Age Groups 20-24, 25-29, and 30-34, 1950-77: Brazil and Regions

Age Group	Estimated Fertility Schedules							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 1: Brazil								
15-19	0.077	0.078	0.075	0.075	0.078	0.078	0.076	0.075
20-24	0.263	0.265	0.256	0.248	0.243	0.235	0.215	0.219
25-29	0.305	0.307	0.297	0.292	0.269	0.265	0.234	0.232
30-34	0.253	0.255	0.247	0.243	0.216	0.219	0.196	0.187
35-39	0.187	0.188	0.183	0.173	0.150	0.155	0.135	0.128
40-44	0.088	0.088	0.086	0.079	0.069	0.070	0.061	0.054
45-49	0.023	0.023	0.023	0.016	0.011	0.010	0.011	0.011
TF	5.987	6.017	5.829	5.622	5.183	5.165	4.641	4.528
Adjustment Factor	1.009	1.075	1.324	1.412	1.264	1.224	1.272	1.216
Part 2: Region 1								
15-19	0.062	0.064	0.061	0.063	0.066	0.063	0.063	0.054
20-24	0.200	0.207	0.196	0.189	0.185	0.184	0.163	0.168
25-29	0.222	0.230	0.217	0.221	0.186	0.183	0.174	0.184
30-34	0.158	0.164	0.155	0.151	0.134	0.128	0.118	0.136
35-39	0.109	0.113	0.107	0.095	0.098	0.088	0.064	0.074
40-44	0.048	0.050	0.047	0.032	0.030	0.024	0.025	0.030
45-49	0.012	0.013	0.012	0.006	0.005	0.000	0.006	0.004
TF	4.058	4.205	3.976	3.780	3.520	3.352	3.072	3.245
Adjustment Factor	0.928	1.084	1.351	1.432	1.250	1.214	1.209	1.226
Part 3: Region 2								
15-19	0.069	0.068	0.063	0.064	0.066	0.064	0.066	0.065
20-24	0.232	0.228	0.209	0.193	0.189	0.182	0.173	0.180
25-29	0.250	0.246	0.226	0.221	0.208	0.199	0.177	0.166
30-34	0.179	0.176	0.162	0.155	0.141	0.142	0.129	0.121
35-39	0.121	0.119	0.109	0.099	0.073	0.082	0.075	0.066
40-44	0.049	0.048	0.045	0.040	0.040	0.040	0.039	0.022
45-49	0.012	0.012	0.109	0.011	0.004	0.009	0.002	0.007
TF	4.565	4.487	4.123	3.915	3.604	3.588	3.307	3.141
Adjustment Factor	0.826	0.973	1.304	1.408	1.164	1.145	1.166	1.087

TABLE 40 (continued)

Age Group	Estimated Fertility Schedules							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 4: Region 3								
15-19	0.083	0.085	0.083	0.075	0.083	0.076	0.075	0.075
20-24	0.263	0.264	0.262	0.257	0.241	0.239	0.212	0.226
25-29	0.276	0.283	0.276	0.271	0.143	0.251	0.224	0.214
30-34	0.221	0.226	0.221	0.211	0.191	0.195	0.183	0.155
35-39	0.166	0.170	0.166	0.156	0.150	0.118	0.118	0.109
40-44	0.082	0.084	0.082	0.076	0.063	0.070	0.049	0.049
45-49	0.020	0.020	0.020	0.026	0.009	0.008	0.011	0.008
TF	5.553	5.682	5.545	5.355	4.898	4.785	4.368	4.176
Adjustment Factor	0.932	1.006	1.301	1.450	1.284	1.221	1.376	1.290
Part 5: Region 4								
15-19	0.068	0.068	0.063	0.063	0.062	0.064	0.060	0.053
20-24	0.282	0.285	0.261	0.245	0.237	0.230	0.211	0.209
25-29	0.346	0.350	0.320	0.290	0.271	0.298	0.244	0.241
30-34	0.303	0.307	0.280	0.273	0.249	0.247	0.196	0.203
35-39	0.236	0.239	0.218	0.215	0.180	0.206	0.160	0.137
40-44	0.115	0.116	0.106	0.115	0.089	0.097	0.071	0.062
45-49	0.030	0.030	0.027	0.020	0.009	0.028	0.016	0.021
TF	6.898	6.975	6.370	6.103	5.486	5.846	4.790	4.632
Adjustment Factor	1.058	1.127	1.399	1.500	1.387	1.439	1.322	1.306
Part 6: Region 5								
15-19	0.079	0.080	0.081	0.091	0.093	0.101	0.096	0.095
20-24	0.286	0.228	0.292	0.304	0.306	0.295	0.270	0.272
25-29	0.360	0.362	0.368	0.382	0.359	0.339	0.303	0.316
30-34	0.330	0.332	0.338	0.350	0.314	0.324	0.297	0.285
35-39	0.252	0.253	0.257	0.256	0.224	0.237	0.214	0.218
40-44	0.121	0.122	0.124	0.117	0.108	0.106	0.102	0.094
45-49	0.034	0.035	0.035	0.018	0.020	0.011	0.021	0.014
TF	7.309	7.357	7.481	7.586	7.117	7.071	6.513	6.468
Adjustment Factor	1.139	1.141	1.340	1.375	1.279	1.193	1.278	1.234

TABLE 40 (continued)

Age Group	Estimated Fertility Schedules							
	1950	1960	1970	1972	1973	1974	1976	1977
Part 7: Region 6								
15-19	--	0.082	0.077	0.062	0.078	0.081	0.062	0.060
20-24	--	0.260	0.244	0.239	0.223	0.247	0.213	0.191
25-29	--	0.296	0.278	0.268	0.238	0.303	0.219	0.219
30-34	--	0.243	0.228	0.188	0.186	0.207	0.162	0.155
35-39	--	0.175	0.164	0.147	0.122	0.173	0.097	0.103
40-44	--	0.082	0.077	0.050	0.041	0.063	0.050	0.033
45-49	--	0.030	0.028	0.029	0.007	0.002	0.007	0.008
TF	--	5.834	5.466	4.914	4.470	5.377	4.049	3.844
Adjustment Factor	--	1.112	1.252	1.585	1.251	1.347	1.238	1.096
Part 8: Region 7								
15-19	0.098	0.102	0.104	--	--	--	--	--
20-24	0.285	0.298	0.303	--	--	--	--	--
25-29	0.326	0.340	0.346	--	--	--	--	--
30-34	0.278	0.291	0.295	--	--	--	--	--
35-39	0.215	0.225	0.228	--	--	--	--	--
40-44	0.104	0.109	0.111	--	--	--	--	--
45-49	0.031	0.032	0.033	--	--	--	--	--
TF	6.679	6.981	7.090	--	--	--	--	--
Adjustment Factor	1.155	1.170	1.293	--	--	--	--	--
Part 9: Region 7, Urban Areas								
15-19	--	--	--	--	0.090	--	0.087	0.105
20-24	--	--	--	--	0.254	--	0.241	0.227
25-29	--	--	--	--	0.271	--	0.249	0.252
30-34	--	--	--	--	0.219	--	0.166	0.175
35-39	--	--	--	--	0.153	--	0.131	0.114
40-44	--	--	--	--	0.063	--	0.059	0.053
45-49	--	--	--	--	0.015	--	0.011	0.008
TF	--	--	--	--	5.328	--	4.717	4.664
Adjustment Factor	--	--	--	--	1.267	--	1.333	1.218

--: not available.

THE OWN-CHILDREN METHOD

As was stated above, the data required for the application of the own-children method are available from three data sources: the 1960 and 1970 censuses and the 1976 PNAD. In the case of the two censuses, tabulations were made from household samples by matching mothers and children on the basis of stated relationship to the head of the household. For the 1976 PNAD no extraneous matching was required because the questionnaire used during the survey included a question on the identity of the mother of each enumerated child and coded her identification number in the child's record whenever they both lived in the same household.

These procedural differences in the creation of the necessary input tabulations are important because different types of biases are likely to arise depending on them. For example, experience has shown that in societies where extended families are common the matching of mothers and children carried out on the basis of stated relationship to the head of the household tends to assign too many children to relatively old mothers, presumably because some children are matched with their grandmothers rather than with their mothers. Such mismatches introduce a positive bias in the age-specific fertility rates of older women, whose effect in terms of old-age fertility cannot be disregarded, especially given the relatively low rates usually prevalent at those ages.

With this caveat in mind, we proceed to present the results obtained by applying the own-children method to the available data sets. Tables 41 through 43 show the age-specific fertility schedules and the corresponding total fertility rates (TF) obtained for Brazil and its regions from the 1960 and 1970 censuses and from the 1976 PNAD. The fertility schedules displayed in these tables refer to three-year periods. They were obtained by averaging the yearly results that are the usual output of the own-children method. Since the analysis was carried out at the regional as well as at the national level, presentation of the yearly estimates in age-specific forms would be more overwhelming than useful. However, for the purposes of evaluation, the total fertility rates associated with the yearly age-specific fertility estimates are displayed graphically in Figures 17 through 23.

Before evaluating the results obtained, it must be recalled that the own-children method depends essentially on the principles of reverse projection, and thus it

suffers from the same deficiencies usually associated with that method. In particular, errors in the recorded age distribution, either of children or of females, cause serious biases in the estimates obtained. In addition, application of the method requires detailed estimates of mortality for the 15-year period preceding the time of interview. Obviously, any error in these estimates will affect the fertility estimates too. However, in practice, biases due to errors in the mortality estimates used are usually minor compared to those due to age-misreporting and differential undercounts by age.

In the case at hand, the fertility estimates that may be derived from the available data sources cover the 1946-76 period, hence mortality estimates for the same period are required. The yearly series of life tables whose derivation was described in the previous chapter was used to apply the own-children method. Therefore, due allowance was made for changes of mortality through time and for the existence of regional differentials in mortality.

Because the own-children method is designed to estimate fertility in closed populations, its use to obtain fertility estimates at the regional level poses some problems, especially with respect to the interpretation of the results obtained. To the extent that the fertility of the population that is lost by emigration or gained through immigration differs from that of the average native population, the estimates yielded by the own-children method will be biased. In the case of Brazil, at the national level such biases are likely to be fairly small, since international migration has not been an important determinant of population growth during the period considered. The same cannot be said for the different regions, whose gain and loss of population through internal migration has been significant. The question arises therefore about how well the reverse-projected number of children now in a given region represent the number of births occurring to the population in that region at some previous point in time. Without detailed estimates of fertility differentials by migratory status and information on the time of arrival of migrants to the region of enumeration, a definitive answer to this question cannot be given. However, one thing remains certain: as long as international migration levels are low, the weighted average of the regional estimates of fertility derived by the own-children method (weighted in terms of the regional distribution of the

TABLE 41 Own-Children Estimates of Fertility by Three-Year Periods Derived from the 1960 Census: Brazil and Regions

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0750	0.0980	0.1032	0.0999	0.1067
20-24	0.2140	0.2582	0.2588	0.2520	0.2548
25-29	0.2238	0.2773	0.2873	0.2653	0.2793
30-34	0.1915	0.2351	0.2389	0.2281	0.2450
35-39	0.1332	0.1629	0.1725	0.1674	0.1731
40-44	0.0672	0.0864	0.0902	0.0872	0.0992
45-49	0.0277	0.0363	0.0397	0.0428	0.0431
TFR	4.6610	5.7709	5.9531	5.7132	6.0061

BRAZIL

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0636	0.0717	0.0720	0.0667	0.0734
20-24	0.1789	0.2079	0.1961	0.1881	0.1822
25-29	0.1687	0.2011	0.2001	0.1926	0.2003
30-34	0.1269	0.1495	0.1615	0.1513	0.1526
35-39	0.0824	0.0951	0.1017	0.0966	0.0969
40-44	0.0350	0.0546	0.0568	0.0448	0.0590
45-49	0.0206	0.0223	0.0245	0.0269	0.0245
TFR	3.3806	4.0106	4.0637	3.8352	3.9446

REGION 1

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0725	0.0881	0.0868	0.0786	0.0738
20-24	0.2093	0.2381	0.2287	0.2179	0.2333
25-29	0.1929	0.2228	0.2319	0.2214	0.2476
30-34	0.1450	0.1764	0.1806	0.1855	0.2019
35-39	0.1004	0.1145	0.1245	0.1277	0.1416
40-44	0.0492	0.0583	0.0629	0.0643	0.0748
45-49	0.0206	0.0251	0.0284	0.0250	0.0284
TFR	3.9442	4.6161	4.7191	4.6015	5.0325

REGION 2

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0760	0.0946	0.1002	0.0961	0.0925
20-24	0.2257	0.2670	0.2709	0.2665	0.2592
25-29	0.2363	0.2800	0.2843	0.2654	0.2737
30-34	0.1970	0.2343	0.2446	0.2341	0.2518
35-39	0.1361	0.1731	0.1815	0.1751	0.1821
40-44	0.0733	0.0886	0.0936	0.0875	0.1017
45-49	0.0253	0.0281	0.0340	0.0357	0.0374
TFR	4.8488	5.8284	6.0452	5.8024	5.9924

REGION 3

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0757	0.1083	0.1118	0.1104	0.1263
20-24	0.2201	0.2752	0.2827	0.2719	0.2750
25-29	0.2414	0.3114	0.3205	0.2903	0.3081
30-34	0.2161	0.2741	0.2630	0.2437	0.2693
35-39	0.1573	0.1876	0.1923	0.1758	0.1921
40-44	0.0799	0.0987	0.0990	0.1001	0.1158
45-49	0.0254	0.0374	0.0422	0.0476	0.0468
TFR	5.0788	6.4635	6.5569	6.1986	6.6674

REGION 4

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0738	0.0996	0.1098	0.1137	0.1288
20-24	0.2109	0.2620	0.2729	0.2743	0.2754
25-29	0.2407	0.3183	0.3333	0.3010	0.3155
30-34	0.2227	0.2776	0.2805	0.2666	0.2850
35-39	0.1526	0.1946	0.2126	0.2039	0.2010
40-44	0.0782	0.1066	0.1096	0.1083	0.1189
45-49	0.0337	0.0488	0.0513	0.0561	0.0583
TFR	5.0628	6.5374	6.8503	6.6190	6.9149

REGION 5

AGE	1958-60	1955-57	1952-54	1949-51	1946-48
15-19	0.0948	0.1298	0.1473	0.1363	0.1437
20-24	0.2430	0.3040	0.2979	0.2820	0.2831
25-29	0.2529	0.3138	0.3265	0.2956	0.2960
30-34	0.2302	0.2713	0.2794	0.2651	0.2856
35-39	0.1576	0.1976	0.1980	0.2029	0.2089
40-44	0.0849	0.1001	0.1066	0.1154	0.1237
45-49	0.0421	0.0561	0.0653	0.0781	0.0619
TFR	5.5278	6.8629	7.1060	6.8769	7.0147

REGION 7

TABLE 42 Own-Children Estimates of Fertility by Three-Year Periods Derived from the 1970 Census: Brazil and Regions

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0696	0.0912	0.1045	0.1086	0.1101
20-24	0.2080	0.2543	0.2689	0.2682	0.2759
25-29	0.2249	0.2716	0.2870	0.2846	0.2841
30-34	0.1852	0.2267	0.2327	0.2319	0.2397
35-39	0.1317	0.1539	0.1680	0.1661	0.1619
40-44	0.0615	0.0754	0.0772	0.0750	0.0831
45-49	0.0150	0.0177	0.0178	0.0205	0.0220
TFR	4.4790	5.4540	5.7810	5.7743	5.8837

BRAZIL

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0546	0.0675	0.0713	0.0794	0.0780
20-24	0.1653	0.1939	0.2120	0.2164	0.2260
25-29	0.1662	0.1959	0.2229	0.2301	0.2168
30-34	0.1221	0.1513	0.1598	0.1561	0.1566
35-39	0.0797	0.0965	0.0996	0.1017	0.1136
40-44	0.0325	0.0415	0.0437	0.0459	0.0443
45-49	0.0095	0.0128	0.0110	0.0098	0.0128
TFR	3.1493	3.7964	4.1021	4.1962	4.2407

REGION 1

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0552	0.0716	0.0816	0.0881	0.0842
20-24	0.1760	0.2133	0.2253	0.2314	0.2372
25-29	0.1737	0.2117	0.2271	0.2275	0.2334
30-34	0.1283	0.1553	0.1630	0.1734	0.1780
35-39	0.0799	0.0956	0.1076	0.1111	0.1124
40-44	0.0329	0.0409	0.0481	0.0426	0.0586
45-49	0.0066	0.0090	0.0094	0.0103	0.0131
TFR	3.2626	3.9870	4.3100	4.4218	4.5850

REGION 2

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0789	0.0968	0.1053	0.1126	0.1133
20-24	0.2225	0.2598	0.2801	0.2827	0.2860
25-29	0.2266	0.2657	0.2830	0.2930	0.2870
30-34	0.1772	0.2191	0.2328	0.2375	0.2376
35-39	0.1345	0.1589	0.1650	0.1763	0.1766
40-44	0.0637	0.0741	0.0848	0.0864	0.0906
45-49	0.0140	0.0173	0.0176	0.0209	0.0199
TFR	4.5864	5.4588	5.8431	6.0470	6.0547

REGION 3

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0578	0.0821	0.1012	0.1124	0.1239
20-24	0.2016	0.2502	0.2777	0.2897	0.2987
25-29	0.2383	0.2879	0.3021	0.3052	0.3142
30-34	0.2028	0.2492	0.2566	0.2591	0.2782
35-39	0.1472	0.1739	0.2000	0.1970	0.1817
40-44	0.0714	0.0919	0.0844	0.0852	0.0939
45-49	0.0165	0.0161	0.0179	0.0188	0.0220
TFR	4.6783	5.7570	6.1998	6.3363	6.5627

REGION 4

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0746	0.1054	0.1248	0.1216	0.1202
20-24	0.2267	0.2923	0.3008	0.2856	0.2906
25-29	0.2659	0.3340	0.3475	0.3248	0.3270
30-34	0.2430	0.3000	0.2989	0.2887	0.3005
35-39	0.1749	0.2074	0.2269	0.2101	0.1922
40-44	0.0884	0.1059	0.1057	0.0997	0.1035
45-49	0.0214	0.0253	0.0271	0.0304	0.0301
TFR	5.4749	6.8517	7.1583	6.8045	6.8207

REGION 5

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.0705	0.0709	0.0964	0.0832	0.0748
20-24	0.2242	0.2557	0.2666	0.2166	0.2516
25-29	0.2290	0.2782	0.2976	0.2351	0.2691
30-34	0.1639	0.2201	0.2290	0.1829	0.1935
35-39	0.1162	0.1386	0.1856	0.1555	0.1721
40-44	0.0464	0.0845	0.0682	0.1157	0.0660
45-49	0.0069	0.0220	0.0073	0.0176	0.0
TFR	4.2861	5.3497	5.7531	5.0[illegible]	5.1357

REGION 6

AGE	1968-70	1965-67	1962-64	1959-61	1956-58
15-19	0.1014	0.1232	0.1386	0.1417	0.1600
20-24	0.2499	0.2978	0.3109	0.3142	0.3352
25-29	0.2562	0.3158	0.3308	0.3337	0.3254
30-34	0.2266	0.2745	0.2802	0.2854	0.2754
35-39	0.1724	0.1941	0.2105	0.1925	0.2168
40-44	0.0819	0.0929	0.0862	0.0935	0.1220
45-49	0.0237	0.0288	0.0271	0.0394	0.0446
TFR	5.5600	6.6357	6.9214	7.0022	7.3970

REGION 7

TABLE 43 Own-Children Estimates of Fertility by Three-Year Periods Derived from the 1976 PNAD: Brazil and Regions

WHOLE COUNTRY

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0624	0.0658	0.0745	0.0848	0.0897
20-24	0.1726	0.1970	0.2143	0.2365	0.2466
25-29	0.1879	0.2203	0.2437	0.2480	0.2594
30-34	0.1531	0.1791	0.1885	0.2020	0.2188
35-39	0.1017	0.1202	0.1398	0.1454	0.1568
40-44	0.0498	0.0586	0.0695	0.0729	0.0715
45-49	0.0085	0.0124	0.0177	0.0174	0.0138
TFR	3.6800	4.2666	4.7399	5.0351	5.2836

REGION 1

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0547	0.0546	0.0575	0.0694	0.0760
20-24	0.1466	0.1472	0.1696	0.1931	0.2018
25-29	0.1581	0.1729	0.1872	0.1865	0.2051
30-34	0.1071	0.1190	0.1194	0.1538	0.1457
35-39	0.0531	0.0667	0.0844	0.0881	0.0981
40-44	0.0272	0.0285	0.0314	0.0428	0.0354
45-49	0.0054	0.0085	0.0145	0.0131	0.0097
TFR	2.7610	2.9876	3.3200	3.7345	3.8591

REGION 2

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0587	0.0536	0.0571	0.0686	0.0774
20-24	0.1583	0.1748	0.1758	0.1904	0.2145
25-29	0.1641	0.1757	0.1845	0.1953	0.2168
30-34	0.1143	0.1252	0.1359	0.1501	0.1622
35-39	0.0669	0.0788	0.0917	0.0956	0.1130
40-44	0.0378	0.0379	0.0381	0.0407	0.0442
45-49	0.0025	0.0059	0.0106	0.0093	0.0052
TFR	3.0136	3.2601	3.4692	3.7500	4.1662

REGION 3

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0638	0.0723	0.0816	0.0892	0.0973
20-24	0.1722	0.2098	0.2271	0.2595	0.2752
25-29	0.1826	0.2089	0.2396	0.2610	0.2793
30-34	0.1377	0.1707	0.1955	0.2052	0.2316
35-39	0.0887	0.1140	0.1343	0.1538	0.1816
40-44	0.0403	0.0589	0.0743	0.0803	0.0704
45-49	0.0075	0.0106	0.0131	0.0179	0.0138
TFR	3.4640	4.2266	4.8274	5.3343	5.7458

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0521	0.0581	0.0688	0.0841	0.0892
20-24	0.1764	0.1954	0.2217	0.2564	0.2689
25-29	0.1946	0.2361	0.2630	0.2907	0.2948
30-34	0.1804	0.1988	0.2088	0.2452	0.2642
35-39	0.1165	0.1478	0.1701	0.1848	0.1745
40-44	0.0603	0.0746	0.0758	0.0843	0.0898
45-49	0.0100	0.0179	0.0183	0.0168	0.0189
TFR	3.9510	4.6431	5.1325	5.8111	6.0017

REGION 4

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0754	0.0780	0.0924	0.1001	0.0977
20-24	0.2042	0.2262	0.2499	0.2624	0.2569
25-29	0.2369	0.2768	0.3069	0.2885	0.2881
30-34	0.2160	0.2442	0.2474	0.2474	0.2739
35-39	0.1615	0.1726	0.2013	0.1917	0.1994
40-44	0.0790	0.0838	0.1086	0.1023	0.1031
45-49	0.0152	0.0186	0.0286	0.0272	0.0208
TFR	4.9410	5.5007	6.1762	6.0985	6.2003

REGION 5

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0548	0.0592	0.0609	0.0850	0.0919
20-24	0.1752	0.1815	0.2061	0.2299	0.2539
25-29	0.1741	0.2059	0.2286	0.2549	0.2813
30-34	0.1350	0.1557	0.1982	0.2227	0.2277
35-39	0.0903	0.1178	0.1332	0.1230	0.1448
40-44	0.0433	0.0501	0.0621	0.0716	0.0726
45-49	0.0087	0.0110	0.0159	0.0121	0.0156
TFR	3.4072	3.9064	4.5248	4.9965	5.4388

REGION 6

AGE	1974-76	1971-73	1968-70	1965-67	1962-64
15-19	0.0781	0.0789	0.0899	0.1000	0.1113
20-24	0.2031	0.2174	0.2455	0.2799	0.2704
25-29	0.2040	0.2419	0.2722	0.2512	0.2701
30-34	0.1531	0.1926	0.2067	0.2054	0.2182
35-39	0.1080	0.1224	0.1354	0.1561	0.1465
40-44	0.0421	0.0560	0.0667	0.0911	0.0869
45-49	0.0134	0.0093	0.0193	0.0173	0.0162
TFR	4.0095	4.5928	5.1785	5.3048	5.5981

REGION 7 (Urban)

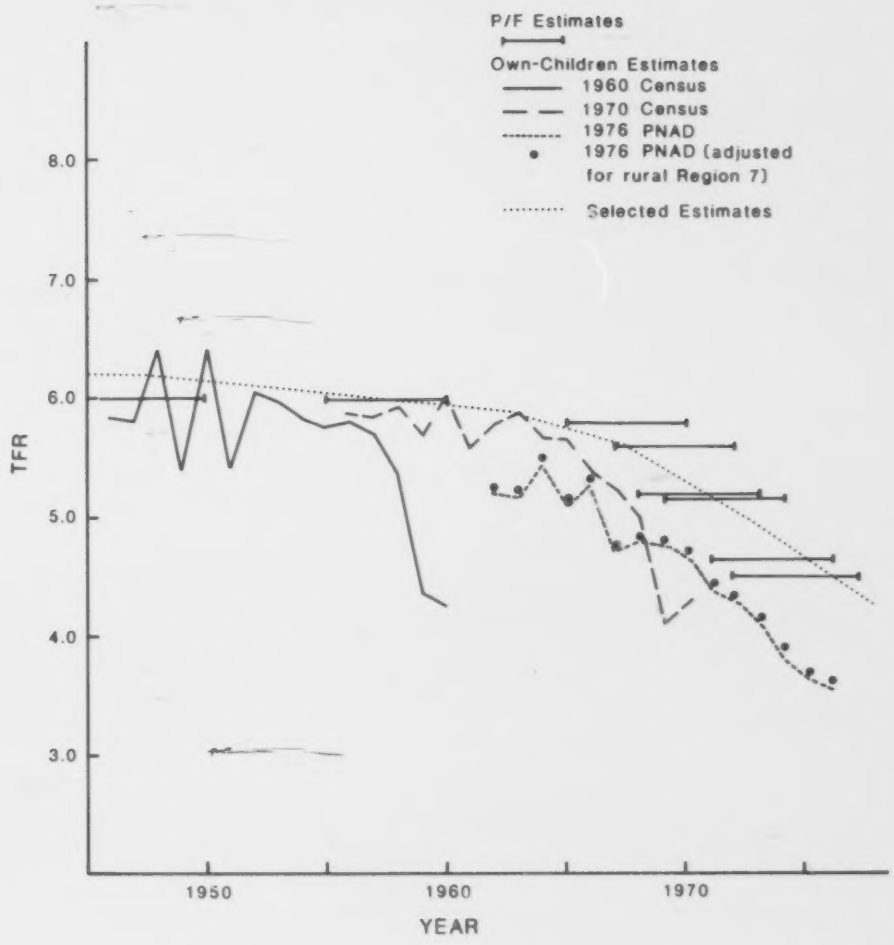


FIGURE 17 Comparison of Total Fertility Estimates, 1946-77: Brazil

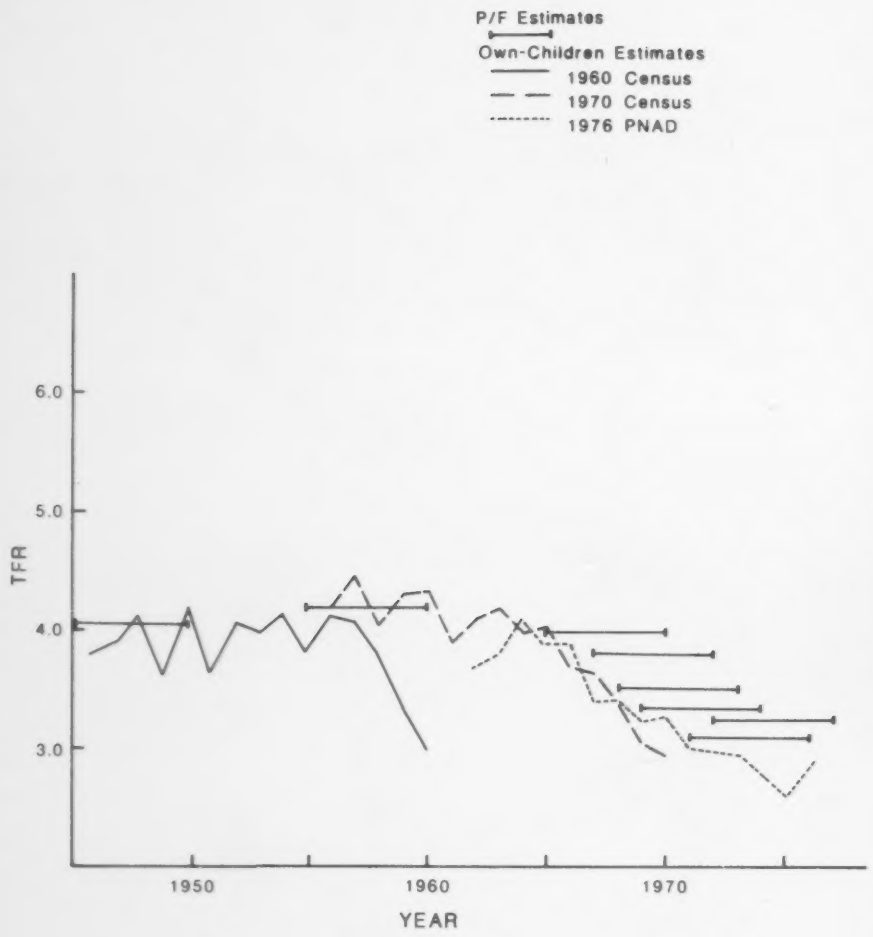


FIGURE 18 Comparison of Total Fertility Estimates, 1946-77, Region 1: Brazil

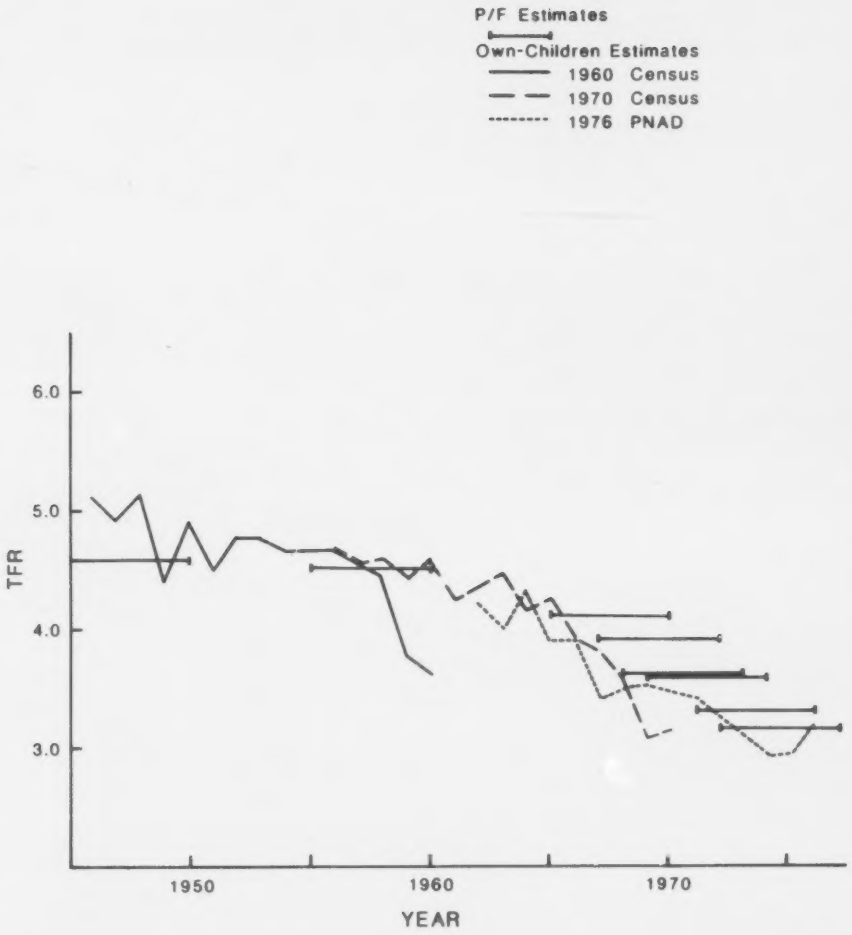


FIGURE 19 Comparison of Total Fertility Estimates, 1946-77, Region 2: Brazil

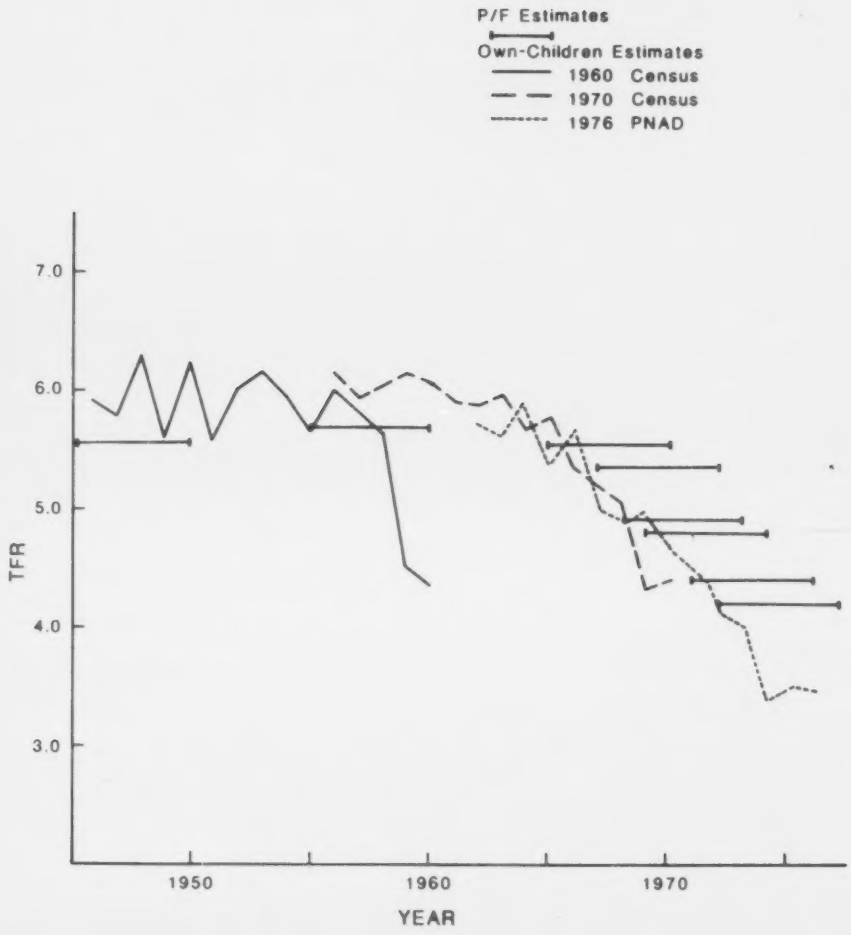


FIGURE 20 Comparison of Total Fertility Estimates, 1946-77, Region 3: Brazil

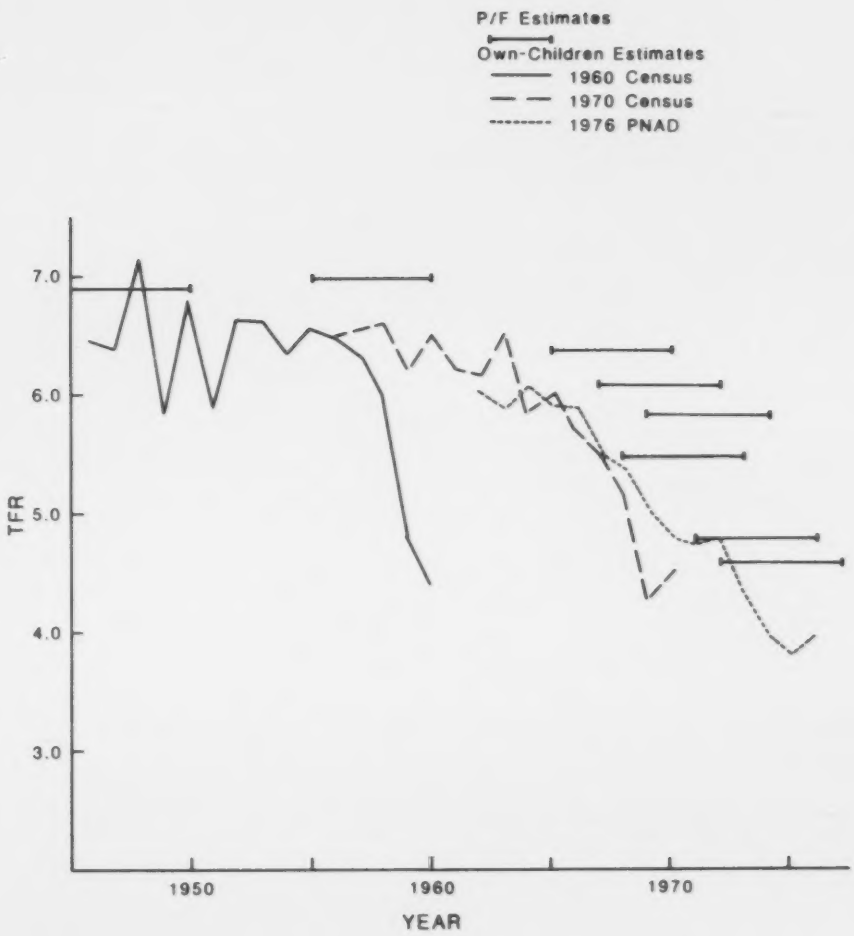


FIGURE 21 Comparison of Total Fertility Estimates, 1946-77, Region 4: Brazil

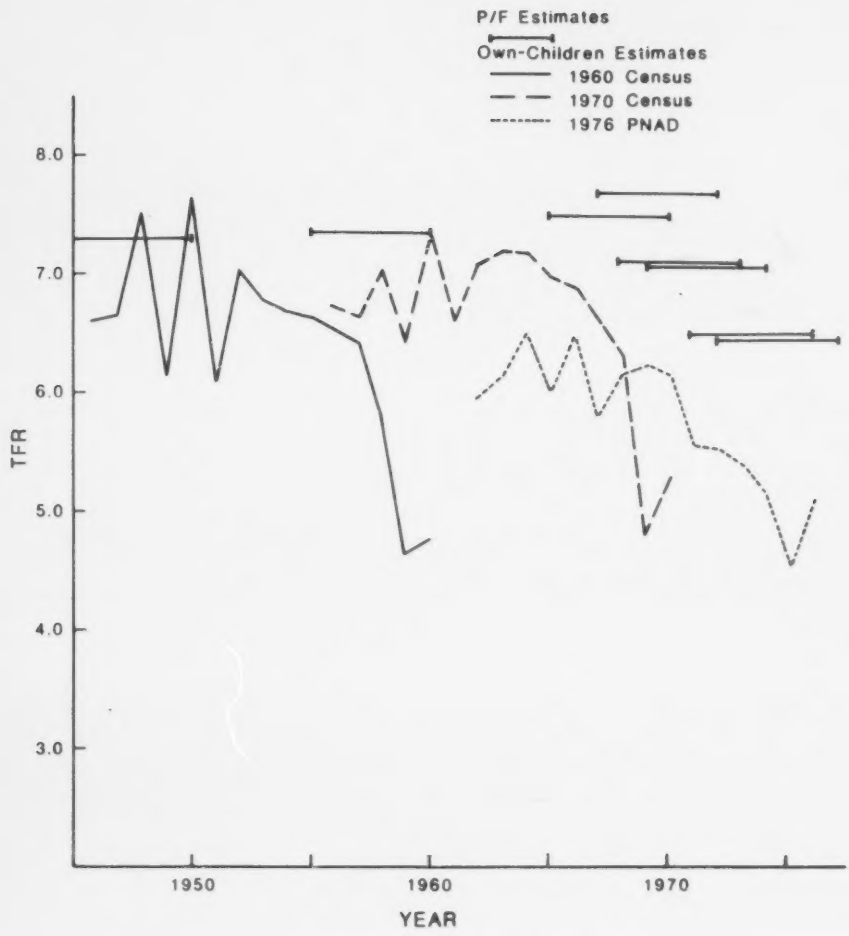


FIGURE 22 Comparison of Total Fertility Estimates, 1946-77, Region 5: Brazil

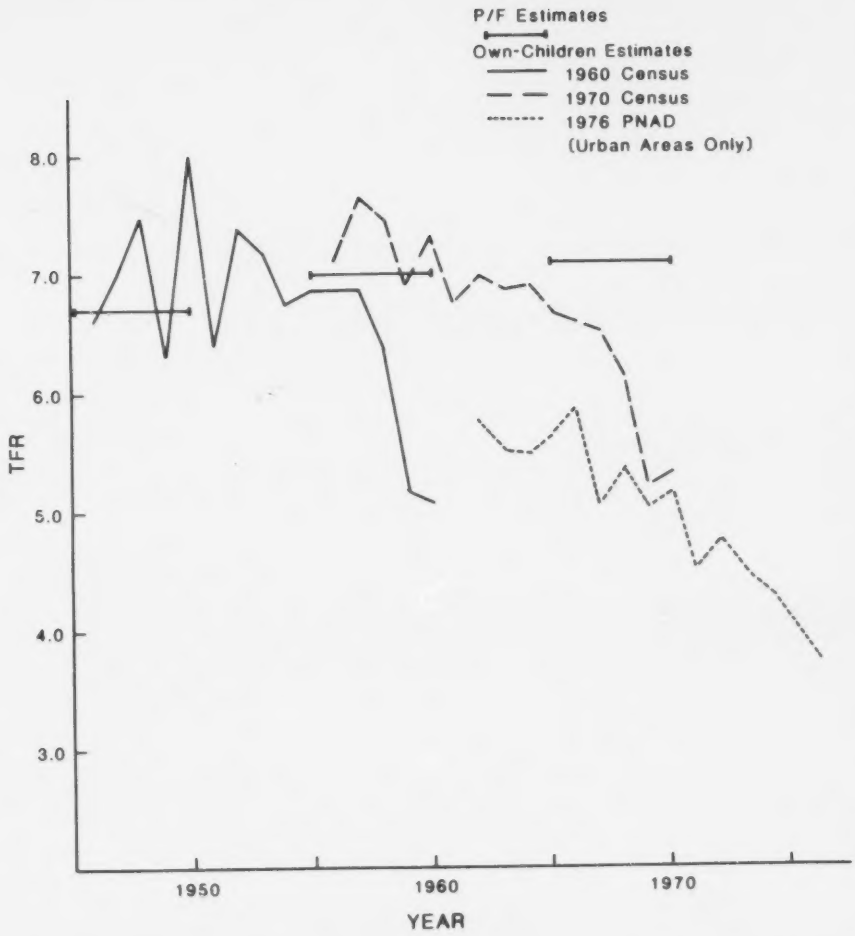


FIGURE 23 Comparison of Total Fertility Estimates, 1946-77, Region 7: Brazil

population at the time of enumeration) is representative of fertility at the national level both at the time of enumeration and for previous periods. Therefore, in the discussion that follows, although regional estimates will be considered separately, emphasis will be given to their implications in terms of the national average.

Own-Children Estimates for Brazil as a Whole

Figure 17 displays the yearly estimates of total fertility derived from the own-children data for the country as a whole. The three distinct curves correspond to the estimates derived from each of the available data sources. Especially striking is the high degree of age heaping exhibited by the 1960 data, which is reflected by the peaks and troughs displayed by the total fertility estimates for the 1946-52 period (associated with ages 9-14). Although similar distortions are observed in the other two sets of estimates, their magnitude is substantially smaller, suggesting that better age reporting was achieved in 1970 and 1976 than in 1960.

Another feature shared by all three sets of estimates is the sharply declining trend displayed by the total fertility estimates derived from children aged 0-4 at the time of enumeration. Such a trend is characteristic of estimates derived by using the own-children method and it is caused by the joint action of differential completeness of enumeration by age and age misreporting. Since the periods for which estimates from different sources overlap include, in particular, the declining sections of the 1960 and 1970 sets, it is evident that their most recent estimates (those derived from children aged 0 and 1) are too low. In the case of the 1960 data, one can argue that even the estimates associated with ages 2, 3, and maybe 4 (1956-58) are biased downward. For 1970, however, the total fertility estimates for the 1962-68 period (corresponding to ages 2 to 8) fall consistently above the estimates for the same period derived from the 1976 PNAD (corresponding to ages 8 to 14). Since usual patterns of age misreporting and differential undercount would lead us to expect the inverse relationship (i.e., that the estimates derived from the 1976 PNAD were greater than those derived from the 1970 census), the observed outcome casts doubts on the accuracy of the estimates derived from the PNAD survey.

One can argue, however, that the PNAD-based estimates cannot be expected to match those yielded by the census because the former do not include the rural areas of Region 7, whose fertility is higher than average. In order to determine roughly the size of the bias due to this omission, a modified set of PNAD own-children estimates was derived by weighting the data for Region 5 by the combined sizes of Region 5 and rural Region 7. Since the fertility levels of these two regions are similar, such a procedure would enhance the representativity of the PNAD estimates at the national level. The modified own-children estimates are displayed in Figure 17. Although consistently greater than the original ones, the difference between the two is hardly significant, and it is certainly not able to account for the large discrepancies observed during the 1962-68 period.

In spite of their flaws, the sets of total fertility estimates displayed in Figure 17 confirm that fertility remained more or less constant until 1965, so that any reduction in fertility levels must have taken place since then. In addition, even though the 1976 data seem weaker than the rest in terms of overall level, it is clear that they imply a declining trend which is consistent with that displayed by fertility estimates derived from information on births last year (see Table 40).

Regional Own-Children Estimates

Examination of the estimates at the regional level sheds some light on the likely causes of the discrepancies observed at the national level. There are two main points to be noted.

First, as Figures 18 through 21 show, the estimates derived from the 1970 census coincide fairly well with those obtained from the 1976 PNAD data for Regions 1 to 4. Furthermore, in all of these regions the trend followed by the total fertility estimates after 1965 is clearly declining, while prior to 1965 only the estimates of Region 2 show some tendency to decrease.

Second, for Regions 5 and 7, large discrepancies are observed between the estimates derived from the 1970 census data and those derived from the 1976 PNAD. The discrepancies for Region 7 would have been expected, since the 1976 PNAD estimates refer only to its urban areas, while all the rest refer to both urban and rural populations combined. But the differences evident in the

estimates for Region 5 are unexpected and have no other justification than the existence of serious reporting errors. Evidently, given the large weight that Region 5 has on the national average (it amounts to about 30 percent of the total), biases affecting its data have significant effects at the national level. Thus, it is not surprising to find that the PNAD estimates for Brazil as a whole are lower than expected.

It must also be noted that, although the overall level of the PNAD estimates for Region 5 is wrong, their trend through time need not necessarily be so. If one accepts it as roughly valid, one can assert that fertility did not decrease in Region 5 prior to 1972 or 1973. Declines may have occurred thereafter, although the own-children estimates provide no foundation on which to validate such a trend.

To conclude, note that the yearly estimates for Region 6 (the Federal District) have been omitted. The reason for this omission is that because it constitutes such a small percentage of the total population (at most 2 percent), its share in the equal-probability samples used to derive the own-children tabulations from the 1960 and 1970 censuses is too small to provide useful estimates. The partial cumulation carried out in deriving the estimates for three-year periods presented in Tables 42 and 43 contributes to the reduction of this problem, but again, the low weight that Region 6 has on the national average does not warrant the detailed analysis of its data.

A REVISED SET OF FERTILITY ESTIMATES FOR BRAZIL AS A WHOLE

Two sets of fertility estimates covering approximately the 1945-77 period have been presented in previous sections. Although each set conveys valuable information about the evolution of fertility in Brazil and its regions since 1945, none is entirely free from error. Therefore, a careful evaluation of the strengths and weaknesses of each is necessary before a definitive set of estimates can be selected.

The most important deficiencies of the available sets have already been noted: the estimates of Table 40, based on the P/F ratio method and henceforward called "P/F estimates," have been derived by choosing an adjustment factor in a rather arbitrary fashion, and although they probably do reflect generally the levels of fertil-

ity prevalent during some period, the decline of fertility suggested by other evidence makes the determination of their true reference dates elusive. On the other hand, the estimates derived via the own-children method (called "own-children estimates" from now on) are affected both by age misreporting and by differential completeness of coverage by age, so that both the levels and the trends they imply (if interpreted strictly) are likely to be wrong. They constitute, however, the best basis available for the determination of trends, provided that estimates derived from certain age groups (very young children, for example) are disregarded.

The availability of regional estimates has brought to light other deficiencies: it appears that the own-children estimates for Region 5 derived from the 1976 PNAD are severely biased downward, causing the same type of bias to appear at the national level. One can only speculate about the causes of such bias, but its existence implies that one cannot use the country-wide 1976 own-children estimates as guidelines in selecting recent fertility levels.

For earlier periods (1945-60) the problems encountered are of a different nature: the lack of data prompted the fabrication of fertility schedules based on more recent information, a scheme that resulted in a set of P/F estimates whose validity is often doubtful. Estimates for the same period are available from the 1960 own-children estimates and, after 1955, from the 1970 set. Unfortunately, for 1945-55 the 1960 estimates are substantially affected by age heaping, so they are of little help in reducing the uncertainties surrounding the estimates for this period. For 1955-60 the evidence seems less ambiguous and more likely to yield acceptable estimates.

To obtain a better idea of how the two sets of estimates being considered compare, refer to Figures 17 through 23. Note that all the P/F estimates are represented by horizontal lines spanning periods of five years before the date of their respective source. As Figures 18 through 20 reveal, for Regions 1, 2, and 3 the P/F estimates are fairly consistent with the own-children ones, provided the reference date of the former is taken to be five years before interview. For Region 4 (see Figure 21), the discrepancies between the P/F and own-children estimates are larger, the P/F frequently being greater than the own-children. For Region 5 (Figure 22), the discrepancies between the two sets are even more

marked, and although the P/F estimates do indicate that a decline has taken place, their levels are substantially higher than those implied by the own-children estimates. Finally, for Region 7 (Figure 23) the few comparisons possible show that, for 1955-70 the P/F estimates are not inconsistent with those derived from own-children data.

Although the P/F and the own-children estimates are in good agreement for some of the country's regions, the discrepancies noted in Regions 4 and 5 are all too patently reflected on the national average, since for Brazil as a whole (see Figure 17) it is clear that the P/F estimates are usually greater than those obtained from own-children data.

In conclusion, it appears that none of the sets of estimates derived so far is in and of itself adequate for the country as a whole. However, the relatively good agreement observed between the two sets for certain regions, and our knowledge about the biases that are most likely to affect the others make it possible to derive an alternative set of country-wide estimates on the basis of the most reliable ones at the regional level. The derivation of this set is described below.

A Revised Set of Total Fertility Estimates for Brazil as a Whole

Table 44 presents the data used in deriving total fertility estimates for the whole country on the basis of the most reliable ones obtained at the regional level. The country-wide estimate is calculated as the weighted average of the regional estimates, using as weights the proportions of women aged 15-49 in each region. The weights are also presented in Table 44. Those for periods before 1971 were computed from the 1950, 1960, and 1970 censuses. The weights for the period labeled 1971-76 were obtained from the 1976 PNAD tabulations (which show the estimated population in each region classified by age and sex) and they exclude the rural population of Region 7. Therefore, strictly speaking, the country-wide total fertility estimate for 1971-76 shown in Table 44 needs to be adjusted to take into account the missing region. Assuming that its population amounted to 4 percent of the total and that it had a total fertility rate of 7.5 during the approximate period considered, the resulting country estimate is 4.60 children per woman.

TABLE 44 Derivation of Revised Total Fertility Estimated for the Whole Country, 1945-76: Brazil

	About 1945-50			About 1955-60		
Region	Weight	TF	Source	Weight	TF	Source
1	0.099	4.40	1950 P/F(2)	0.102	4.20	1960 P/F
2	0.182	4.70	1950 P/F(2,3)	0.191	4.50	1960 P/F
3	0.147	6.00	1960 OC	0.163	6.00	1970 OC
4	0.164	6.50	1960 OC	0.152	6.50	1970 OC
5	0.342	7.30	1970 OC	0.317	7.30	1970 OC
6	0.000	--	--	0.002	5.10	1970 OC
7	0.066	7.50	1960 P/F	0.073	7.00	1960 PF
Total	1.000	6.20		1.000	6.09	

	About 1965-70			About 1971-76		
Region	Weight	TF	Source	Weight[a]	TF	Source
1	0.106	4.00	1970 P/F	0.112	3.25	1977 P/F
2	0.202	4.10	1970 P/F	0.219	3.31	1976 P/F
3	0.173	5.60	1970 P/F	0.189	4.37	1976 P/F
4	0.138	6.40	1970 P/F	0.136	4.79	1976 P/F
5	0.294	7.30	1970 OC	0.288	6.51	1976 P/F
6	0.006	5.00	1970 P/F	0.009	4.05	1976 P/F
7	0.081	7.00	1970 P/F	0.046	4.72	1976 P/F
Total	1.000	5.85		0.999	4.48	

Note: When an estimate corresponding to the rural population of Region 7 is added to the calculations, the TF estimate for 1971-76 increases to 4.60.

[a]Excluding rural areas of Region 7.

Table 44 also indicates the source of the regional estimates selected. The P/F estimates are identified by the data of their source (1950, 1960, 1970, etc.) and, occasionally, by the age groups whose P/F ratios were used to adjust the observed fertility schedule (2 stands for 20-24, 3 for 25-29). Whenever the age-group indicators are missing, the P/F estimates are those presented in Table 40.

The own-children estimates are also accompanied by the date of their data source. However, no attempt was made to indicate exactly from which period they were extracted. In some cases, the own-children estimates selected cor-

respond to a given year (1949-50 for example), while in others they are rough averages of the yearly estimates of a whole period (1946-54 for example).

Another item of Table 44 that is less precise than one might wish are the "period indicators" (about 1945-50, about 1955-60). They are used to show explicitly that the estimates presented do not have a very specific reference date, even though, especially for periods after 1965, they were obtained from sources located at the end of the period indicated (the 1970 census and the 1976 PNAD).

It is noteworthy that most of the estimates selected for periods prior to 1960 were derived from the own-children set, while the majority of those selected for later periods are P/F estimates. This strategy had to be followed because of the serious deficiencies noted in the own-children estimates derived from the 1976 PNAD, and because of the weakness of the P/F estimates prior to 1970.

It should also be noted that according to Table 44, total fertility for Brazil as a whole shows a tendency to decline even as early as 1955-60. However, except for Regions 1 and 2 where a fairly small decline was incorporated in the selected estimates, and for the emergence of Region 6, the total fertility rates for all other regions were left unchanged. Thus, at least half of the relatively small reduction in total fertility observed from 1945-50 to 1955-60 is due to the internal redistribution of the population, rather than to changes in fertility at the regional level. By 1965-70, several regions were showing reductions in fertility, although most of them were still fairly small. Only during the period labeled 1971-76 do sharp reductions become evident in most regions.

Although there is reason to believe that the estimates presented in Table 44 are more reliable than those presented before for similar periods, the question as to their true reference date still remains unanswered. While fertility was changing very slowly (before 1965), a very accurate determination of such dates is probably not necessary, but for more recent periods it is of crucial importance.

To shed some light on this point, a fertility estimation method that produces estimates with a well-defined reference date even during periods of fertility change was applied to Brazilian data for the 1972-77 period. The method used allows intersurvey fertility to be estimated from data gathered by two surveys 5 years

Table 45 Estimation of Intersurvey Fertility, 1972(73)-77: Brazil

Age Group	1972-73 $P_1(i)$	1977 $P_2(i)$	$P(i,s)$	$\bar{f}(i,s)$	P/F	Adjusted $\bar{f}(i)$
15-19	0.1149	0.1138	0.1138	0.0483	1.15	0.0685
20-24	0.9196	0.8385	0.8374	0.1730	1.15	0.2097
25-29	2.3248	2.0247	1.9425	0.2013	1.13	0.2308
30-34	3.7354	3.3650	2.9827	0.1676	1.13	0.1876
35-39	4.8367	4.5325	3.7798	0.1184	1.14	0.1302
40-44	5.5230	5.1985	4.1416	0.0558	1.11	0.0574
45-49	5.8187	5.5765	4.1951	0.0124	1.08	0.0107
TF				3.8840		4.4746

apart (Zlotnik and Hill, 1981). In Brazil the 1972 and the 1977 PNADs could be used for such purposes. However, because the 1972 PNAD excludes Region 7 completely, it was decided to average its results with those recorded by the 1973 PNAD and use such an average as the starting point. The basic data used and the resulting adjusted fertility estimates are shown in Table 45. The near coincidence of the intersurvey estimate of total fertility (4.47) with that shown in Table 44 for 1971-76 suggests that the reference date of the latter is closer to 1976 than to 1971. On the basis of this evidence, the total fertility estimate adjusted for the exclusion of rural Region 7 (4.60) was assigned 1975.0 as reference date. This estimate, together with those presented in Table 44 for periods prior to 1971, were used as guidelines to derive a smooth series of revised total fertility estimates. They are presented in Table 46 and displayed as a dotted line in Figure 17.

A Revised Series of Age-Specific Fertility Estimates for Brazil as a Whole

The two sets of fertility estimates presented above included age-specific fertility schedules. It is widely recognized that fertility changes over time affect not only the level of fertility but also its pattern with respect to age. This section explores the changing patterns of age-specific fertility in Brazil as a whole.

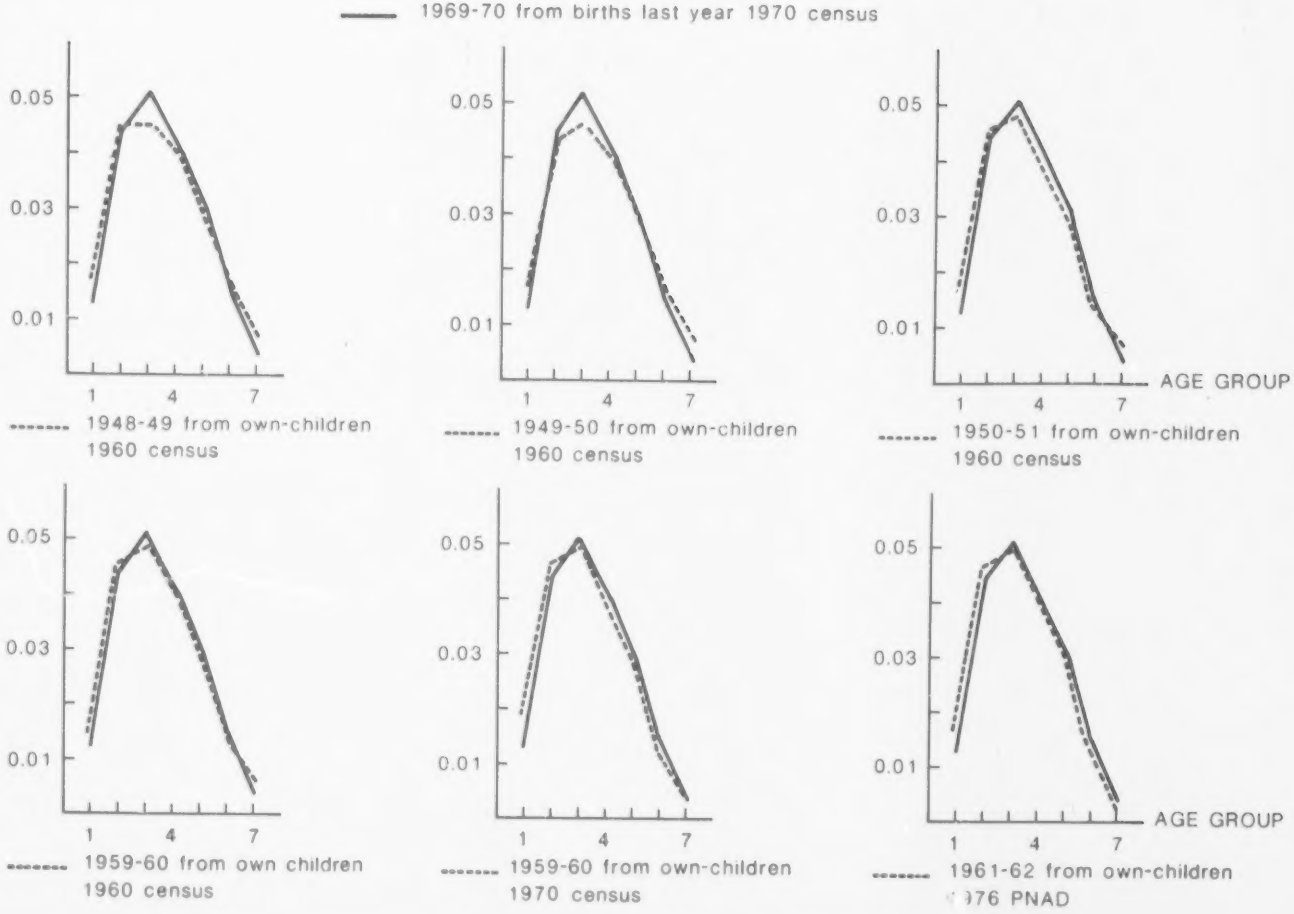
The graphs in Figure 24 compare the pattern of age-specific fertility for different periods as recorded by

TABLE 46 Selected Set of Total Fertility Estimates for the Country as a Whole, 1940-77: Brazil

Date	Total Fertility
1940.0	6.25
1942.5	6.25
1947.5	6.20
1952.5	6.10
1957.5	6.00
1962.5	5.90
1967.5	5.60
1972.5	5.00
1977.5	4.30

various sources. Because only the pattern is of interest, the age-specific fertility schedules have been rescaled so that their total fertility is one. To distinguish these rescaled schedules from those actually observed, they are denominated "fertility density functions".

The solid line in all the panels of Figure 24 plots the fertility density function derived from information on "births last year" recorded by the 1970 census. This schedule was selected as a basis for comparisons because, as explained earlier, it was assumed to have remained constant in shape during the 1950-70 period in order to be used in the application of the P/F ratio method to the 1950 and 1960 census data. Since information on the number of births occurring during the year preceding interview was not collected by these censuses, the only independent evidence regarding the pattern of fertility prior to 1960 must be obtained from own-children estimates. Thus, the first three panels of Figure 24 compare fertility density functions derived from own-children data and referring to periods around 1950 with the 1970 births-last-year pattern. If the own-children estimates are correct, it is evident that the 1970 schedule provides a fairly poor approximation to the true pattern of fertility during that period. It must be added, however, that although the own-children estimates presented refer to adjacent years, they are not as similar as one would


1969-70 from births last year 1970 census
0.05
0.03
0.01
1
4
7
AGE GROUP
1948-49 from own-children 1960 census
1949-50 from own-children 1960 census
1950-51 from own-children 1960 census
1959-60 from own children 1960 census
1959-60 from own-children 1970 census
1961-62 from own-children 1976 PNAD

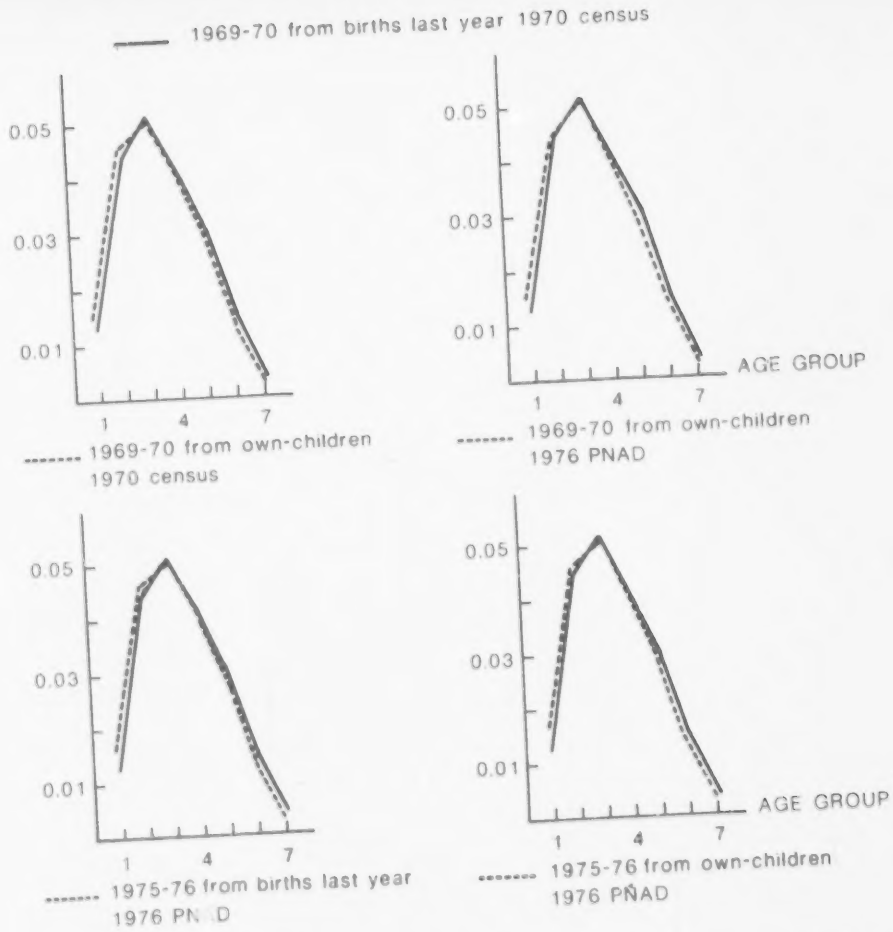


FIGURE 24 Comparison of Fertility Density Functions from Different Sources: Brazil

desire. The one estimated for 1949-50 appears to have the least distorted shape.

The next three panels of Figure 24 compare the 1970 "births last year" fertility density function with those referring approximately to the 1959-60 period, derived from own-children data of various sources. The agreement between the 1960 fertility densities and the 1970 one is better than that observed between the 1950 set and 1970. In addition, there is better agreement between the 1960 densities themselves, a reassuring fact.

The last four panels in Figure 24 compare the same 1969-70 fertility density function (derived from 1970 "births last year") with two own-children fertility densities referring to 1969-70 and with two densities for 1975-76. The very close agreement observed between the densities referring to 1969-70 is evidence of the relatively good quality of the data at hand, as is the fact that the 1975-76 densities deviate from that recorded in 1970 in the expected fashion: they are lower at older ages, as is typically the case when fertility has declined.

Using these comparisons as guidelines, "representative" fertility density functions for the periods 1949-50, 1959-60, 1969-70, and 1975-76 were selected. They are presented in Table 47, together with the α and β values that define model fertility density functions fitted to them within the Gompertz system (Brass, 1981). The selected densities are also plotted in Figure 25 to show that their evolution through time is acceptable; their shape has tended to become more "peaked" due to a reduction in the contribution of older age groups. The fitted values are displayed graphically in Figure 26.

Although the evolution of fertility patterns according to the fitted densities has been generally quite similar to that suggested by the observed ones, there are noticeable differences between the two. The fitted densities evolve fairly smoothly, keeping the essential pattern of the middle age range (age groups 2, 3, and 4, i.e., 20-24, 25-29, and 30-34) virtually unchanged; they also show a slower and more general (in terms of age groups affected) decline at older ages. This behavior contrasts with the somewhat ragged evolution of the shape of the observed densities in the middle age range, and with the sharper decline they display at the oldest age group (7 or 45-49). In addition, it is clear that the values they attain at this age group are substantially higher than those attained by the fitted densities. Given that most of the

TABLE 47 Selected Set of Fertility Density Functions for the Country as a Whole: Brazil

Age Group	1949-50[a]	1959-60[b]	1969-70[c]	1975-76[d]
15-19	0.0168	0.0146	0.0149	0.0165
20-24	0.0428	0.0455	0.0458	0.0463
25-29	0.0465	0.0485	0.0507	0.0504
30-34	0.0405	0.0419	0.0416	0.0421
35-39	0.0298	0.0300	0.0303	0.0291
40-44	0.0157	0.0138	0.0134	0.0132
45-49	0.0079	0.0058	0.0033	0.0024
α	0.2302	0.2356	0.2154	0.1766
β	-0.9567	-1.0201	-1.0472	-1.0520

[a]1960 own children.
[b]1960 own children.
[c]1970 own children.
[c]1976 births last year.

observed densities were derived from own-children data, the discrepancies noticed at older age groups are not surprising. They are almost certainly due to the typical biases affecting the basic data, such as those caused by the erroneous assignment of young children to their grandmothers. It would appear, therefore, that in spite of the discrepancies noticed, the fitted densities are to be preferred to the observed, since they "correct" some of the biases present in the latter.

The availability of α and β parameters defining acceptable fertility density functions for specified periods allows us to derive appropriate densities for other points in time by interpolating between the α and β values. This procedure was followed to obtain α and β estimates referring approximately to the middle of each quinquennial period 1945-49, 1950-54, ..., 1975-80. They are shown in Table 48. Given these estimates, the use of the Gompertz system of fertility models permits the estimation of the corresponding density functions which, coupled with the total fertility estimates of Table 46, yield the age-specific fertility schedules also presented in Table 48.

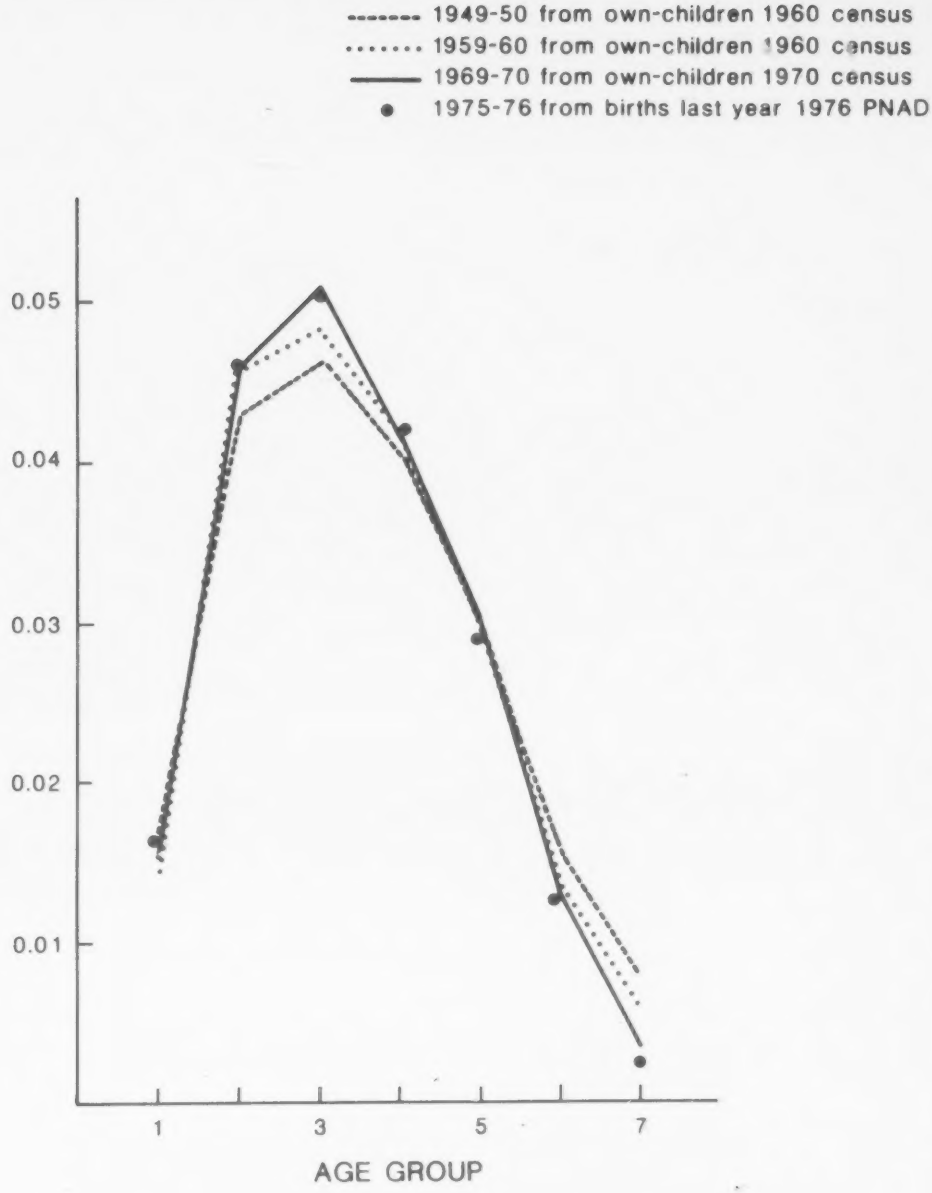


FIGURE 25 Graphic Comparison of the Selected Set of Fertility Density Functions: Brazil

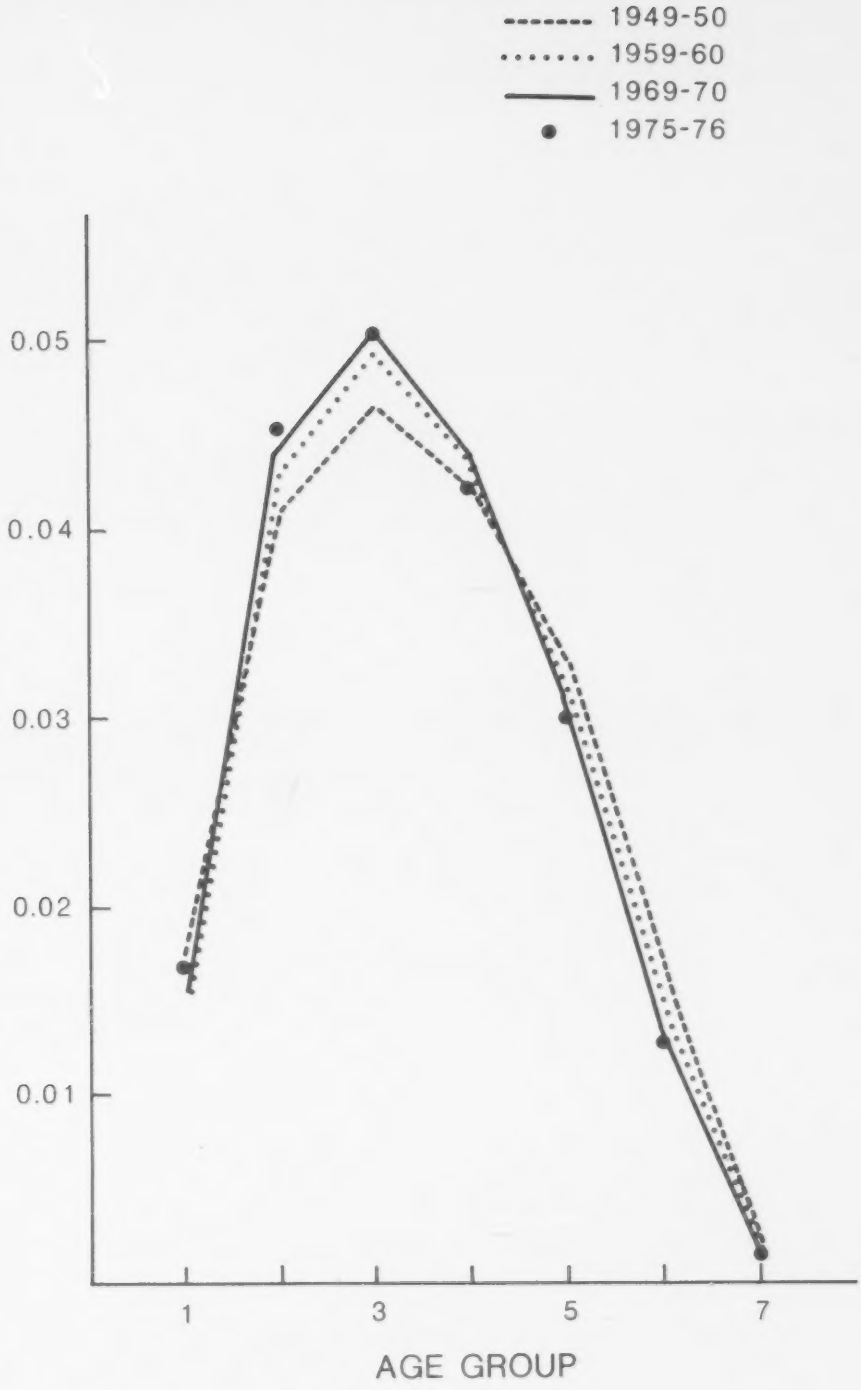


FIGURE 26 Graphic Comparison of the Fitted Set of Fertility Density Functions: Brazil

TABLE 48 Final Set of Estimated Age-Specific Fertility Schedules for the Country as a Whole, 1940-80: Brazil

Age Group	Reference Period							
	1940-44	1945-49	1950-54	1955-59	1960-64	1965-69	1970-74	1975-79
15-19	0.1091	0.1082	0.1034	0.0957	0.0911	0.0866	0.0801	0.0740
20-24	0.2569	0.2549	0.2535	0.2545	0.2548	0.2459	0.2241	0.1975
25-29	0.2903	0.2879	0.2877	0.2915	0.2926	0.2808	0.2520	0.2164
30-34	0.2643	0.2622	0.2600	0.2594	0.2568	0.2434	0.2155	0.1821
35-39	0.2081	0.2065	0.2016	0.1951	0.1885	0.1758	0.1535	0.1282
40-44	0.1056	0.1048	0.0998	0.0919	0.0856	0.0781	0.0670	0.0554
45-49	0.0157	0.0156	0.0142	0.0121	0.0106	0.0094	0.0078	0.0064
TF		6.2000	6.1000	6.0000	5.9000	5.6000	5.0000	4.3000
	0.2302	0.2302	0.2315	0.2342	0.2309	0.2208	0.2008	0.1695
	-0.9567	-0.9567	-0.9723	-1.0034	-1.0264	-1.0400	-1.0490	-1.0529

CONCLUSION

In this chapter, a series of age-specific fertility estimates covering the 1940-80 period has been derived for Brazil as a whole. Consideration of fertility estimates at the regional level has been essential in this derivation, since certain biases could be deleted or corrected, to the degree possible, only at the regional level. However, although a series of indicators of fertility levels at the regional level was selected (see Table 44), no attempt was made to transform them into a consistent series of age-specific fertility estimates for the period considered. Such a task is beyond the scope of this report. However, all the elements required to carry it out have been presented. The implications that the fertility estimates derived have in terms of population growth are analyzed in some detail in the following chapter.

CHAPTER 4

POPULATION GROWTH

COMPONENTS OF GROWTH

In order to derive measures of the components of growth of the Brazilian population from the fertility and mortality schedules derived in previous chapters it is necessary to use a starting or baseline population classified by age and sex. Because most of the estimates obtained refer to the 1940-70 period, the starting date was fixed at 1940. For that year, the 1940 census provides an age and sex distribution for the enumerated population. However, the use of such distribution for the purpose at hand is not recommended because of the age-reporting and coverage errors that affect it. One possible strategy to reduce the effects of errors is to smooth the reported age distribution by means of statistical techniques. Another, somewhat more satisfactory when differential coverage by age is likely to affect the enumerated population, is to use a model age distribution that approximates the observed. However, age distributions derived via models will, in general, not reflect any deviant, though real, characteristics of the observed population. In particular, if the age distribution of a stable population were used to approximate the observed, it would probably fail to reflect changes in the age structure brought about by fertility fluctuations, long-term mortality changes and migration. Yet, given the evolution of the Brazilian population during the late nineteenth and early twentieth centuries, it can be argued that the effects of mortality change and migration are likely to cancel each other out because declining mortality leads, in general, to a younger population, while the influx of adults through immigration will tend to counterbalance the increasing weight of the younger

age groups. Therefore, even though a stable population generated according to the mortality level prevalent around 1940 would, strictly speaking, have an older age distribution than the native population which has been subject to a long-term mortality decline, it may nevertheless approximate well the actual population which was subject not only to declining mortality, but also to substantial influxes of migrants prior to 1900. This expectation was corroborated by comparisons between the age distributions of, on the one hand, the native-born Brazilian population and the total population enumerated in 1940 and, on the other, the stable population generated on the basis of the fertility and mortality estimates for 1940 already presented. For this reason, the stable age distribution was used to construct the baseline population for 1940, which was then projected forward according to the fertility and mortality estimated for different periods to yield estimates of the population's size and age structure at different points in time.

Tables 49 and 50 show some of the results obtained when this procedure was applied to the Brazilian data. Specifically, it displays estimated birth and death rates and rates of natural increase for each sex for each five-year period since 1940. Table 50 shows the estimated population at the time of the different censuses and the corresponding estimates of completeness of enumeration. Notice that the 1940 female population was used to determine the size of the baseline population, and thus its completeness of enumeration is 1.0. Such a choice can be partly justified by the fact that the observed sex ratios of the population are too low (see Table 5), suggesting that, overall, males were less accurately enumerated than females. This assumption is reflected in the completeness estimates obtained, which are certainly lower for males than for females. Obviously, these estimates cannot and should not be interpreted in an absolute fashion: only their differences convey information about the relative completeness of enumeration attained by one census with respect to another. Viewed in this way the three series of completeness estimates presented in Table 50 reveal that the 1950 census achieved a lower completeness of coverage than the rest and that the completeness of coverage attained by all the other censuses is more or less the same.

To the extent in which the constructed population evolves in ways similar to the one observed or that comparisons between the two corroborate deficiencies that

TABLE 49 Estimated Quinquennial Birth Rates, Death Rates, and Rates of Natural Increase, by Sex, 1940-80: Brazil

Period	Male			Female			Both Sexes		
	Birth Rate	Death Rate	Rate of Natural Increase	Birth Rate	Death Rate	Rate of Natural Increase	Birth Rate	Death Rate	Rate of Natural Increase
1940	.0450	.0195	.0255	.0436	.0181	.0255	.0443	.0188	.0255
1940-44	.0449	.0190	.0260	.0435	.0176	.0259	.0442	.0183	.0259
1945-49	.0445	.0178	.0267	.0431	.0165	.0266	.0438	.0172	.0266
1950-54	.0437	.0166	.0271	.0423	.0153	.0270	.0430	.0160	.0270
1955-59	.0431	.0155	.0276	.0417	.0142	.0275	.0424	.0148	.0276
1960-64	.0425	.0141	.0283	.0411	.0129	.0283	.0418	.0135	.0283
1965-69	.0405	.0125	.0280	.0393	.0113	.0280	.0399	.0119	.0280
1970-74	.0367	.0107	.0260	.0356	.0096	.0260	.0362	.0102	.0260
1975-79	.0325	.0091	.0234	.0315	.0082	.0234	.0320	.0086	.0234

TABLE 50 Estimated Population (in thousands) at the Time of the Censuses and Estimated Completeness of Enumeration, 1940-80: Brazil

Year	Estimated Count			Completeness of Enumeration[a]		
	Male	Female	Both Sexes	Male	Female	Both Sexes
1940	20,874	20,626	41,500	0.988	1.000	0.994
1950	27,054	26,721	53,775	0.957	0.976	0.967
1960	35,747	35,294	71,041	0.981	0.995	0.988
1970	47,342	46,735	94,077	0.979	1.002	0.990
1980	60,461	59,673	120,134	0.978	1.005	0.991

Note: The sex ratio at birth used is 1.045.

[a]Relative to the completeness of coverage of females in 1940.

had already been noted in the observed population, the estimated population helps to validate the acceptability of the mortality and fertility estimates used to derive it. For example, in the chapter on mortality, the estimation of mortality levels on the basis of intercensal comparisons led us to conclude that the 1950 census was more deficient than the rest with respect to census coverage. By eliminating it from the series of census counts, a revised set of intercensal growth rates was derived (see Table 22). Table 51 displays a comparable set for the reconstructed population. Examination of the two sets shows that the agreement between them is acceptable. In addition, the 1940 growth rates presented in Table 24 almost coincide with those calculated for the stable population generated on the basis of the estimated fertility and mortality schedules (see Table 49). The results of these comparisons are encouraging, since they do not reveal the existence of serious biases in the reconstructed population.

For this reason, it seems appropriate to adopt the estimates presented in Table 49 as trustworthy indicators of the evolution of the Brazilian population since 1940. According to such estimates the birth rate in Brazil would have declined from 44.3 births per 1,000 population in 1940 to some 32 births per 1,000 in 1975-79, a reduction of approximately 28 percent; whereas the death rate declined by more than 50 percent during the same period, changing from 18.8 deaths per 1,000 in 1940 to some 8.6 deaths per 1,000 in 1975-79. The combination of these two downward trends in the main components of population growth led to an inverted U-shaped trend in the rate of natural increase: it increased steadily from 1940 to 1960-64, only to decline thereafter at an ever-increasing

TABLE 51 Estimated Intercensal Rates of Natural Increase, 1940-80: Brazil

Period	Male	Female
1940-50	.0263	.0263
1950-60	.0273	.0273
1960-70	.0282	.0281
1970-80	.0249	.0247

rate. Thus, by the latter half of the 1970-79 decade, Brazil's population was growing more slowly than it ever had since 1940.

One cannot conclude this brief overview on population growth without making some reference to its third determinant: international migration. Almost no mention has been made of this component in the body of this report, mainly because it is particularly difficult to obtain reliable estimates of its magnitude (see footnote on page 93). Thus, although in strict terms the Brazilian population has not been closed to international migration during the period considered, it has been implicitly assumed throughout this report that levels of net international migration have been almost negligible, an assumption that is validated to some extent by the good fit observed between the reconstructed population and the one observed (see Table 50).

AGE DISTRIBUTION OF THE POPULATION

Table 52 presents the estimated age distributions of the Brazilian population at approximately the dates of the different censuses. Comparisons between the estimated and the observed age distributions are of special interest because they may shed light on the pattern and magnitude of the errors affecting the latter, and on the deviant, though possibly real, characteristics of the Brazilian population.

Figure 27 presents a graphic comparison of the observed and the estimated age distributions. Specifically, the values plotted in Figure 27 are the proportionate deviations of the expected proportion in age group x to x + 4 from the observed, expressed on a percentage basis or, in mathematical terms:

$$ {}_5R_x = 100 \frac{{}_5C_x^e - {}_5C_x^o}{{}_5C_x^e} $$

where ${}_5C_x$ is the proportion of the population aged x to x + 4, and the superindexes o and e indicate, respectively, the observed and estimated quantities. Thus, a positive value of ${}_5R_x$ implies that ${}_5C_x^o < {}_5C_x^e$ and the inverse relationship, ${}_5C_x^o > {}_5C_x^e$ is implied by a negative value of ${}_5R_x$.

TABLE 52 Estimated Age Distributions at the Time of the Censuses, 1940-80: Brazil

Age Group	1940	1950	1960	1970	1980
Male					
0-4	.1715	.1719	.1698	.1649	.1392
5-9	.1400	.1408	.1406	.1416	.1330
10-14	.1206	.1203	.1211	.1206	.1239
15-19	.1040	.1037	.1038	.1036	.1089
20-24	.0892	.0890	.0885	.0890	.0925
25-29	.0759	.0757	.0755	.0757	.0789
30-34	.0646	.0641	.0642	.0641	.0675
35-39	.0546	.0541	.0542	.0543	.0571
40-44	.0455	.0453	.0453	.0457	.0479
45-49	.0371	.0375	.0374	.0379	.0400
50-54	.0296	.0302	.0304	.0308	.0328
55-59	.0233	.0235	.0240	.0244	.0261
60-64	.0177	.0174	.0181	.0186	.0200
65-69	.0126	.0122	.0126	.0132	.0144
70-74	.0079	.0079	.0080	.0085	.0095
75-79	.0041	.0043	.0044	.0047	.0054
80+	.0019	.0021	.0023	.0024	.0029
Female					
0-4	.1688	.1692	.1670	.1622	.1362
5-9	.1380	.1388	.1386	.1394	.1308
10-14	.1188	.1186	.1194	.1190	.1223
15-19	.1024	.1022	.1025	.1023	.1075
20-24	.0878	.0877	.0874	.0881	.0916
25-29	.0749	.0747	.0746	.0751	.0783
30-34	.0639	.0634	.0635	.0636	.0671
35-39	.0542	.0537	.0537	.0539	.0569
40-44	.0455	.0453	.0452	.0456	.0479
45-49	.0377	.0380	.0378	.0381	.0402
50-54	.0308	.0313	.0314	.0315	.0334
55-59	.0249	.0251	.0255	.0256	.0272
60-64	.0197	.0193	.0199	.0203	.0216
65-69	.0146	.0142	.0146	.0152	.0163
70-74	.0098	.0097	.0098	.0104	.0114
75-79	.0055	.0057	.0058	.0062	.0070
80+	.0028	.0031	.0033	.0036	.0043

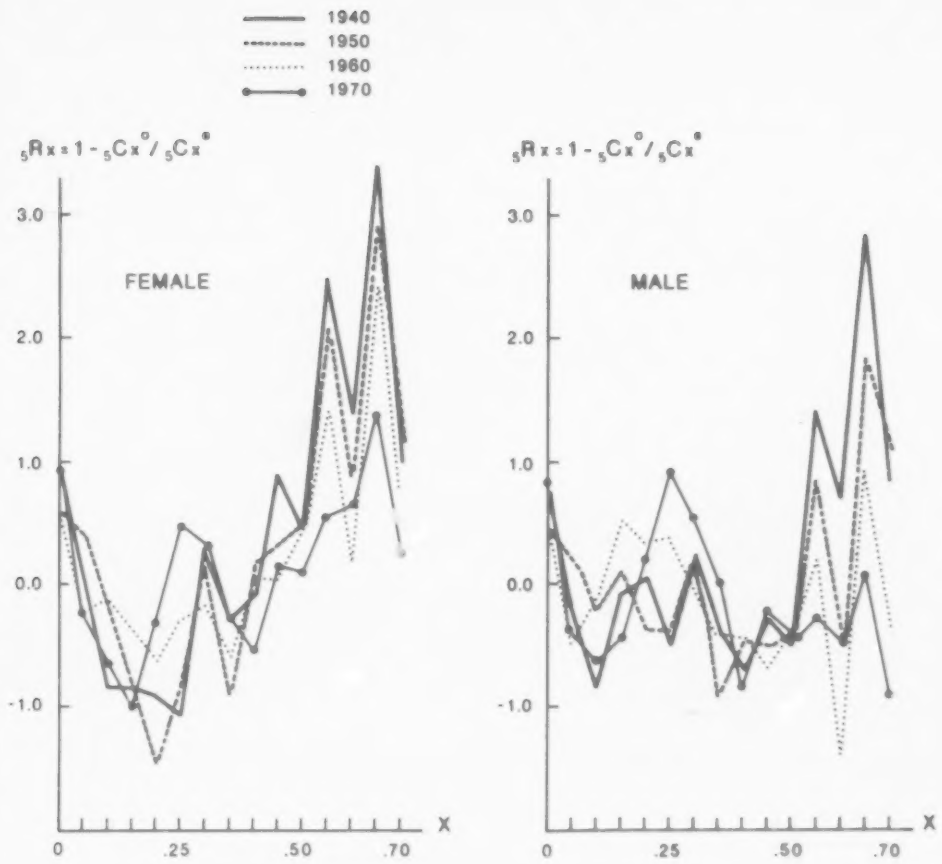


FIGURE 27 Comparison of the Observed and Estimated Age Distribution, 1940-70: Brazil

The effects of international migration have been considered. The little evidence available suggests that migration to Brazil during the period 1940-70 was almost negligible. Also, the projection fits better the whole population than the native-born population taken separately, perhaps because of roughly equal migration into and out of Brazil.

Examination of the plots in Figure 27 reveals that the discrepancies between the observed and the estimated age distributions are greater among females than among males, and that while the pattern of age-reporting errors for females has remained fairly constant from one census to the next, the deviation pattern observed for males in 1970 is quite different from that observed in 1940.

In particular, all the female age distributions currently available appear to have a deficit of females above age 45, while, on average, there appears to have been an excessive proportion reported in the 15-44 age range (although in 1970 the recorded excess is probably small). In contrast, for males an excessive proportion at older ages is noticed only in 1940 (above age 55) and somewhat in 1950 (above age 65), since for later censuses the proportion of males over age 40 appears to have been overreported, if only to a relatively small extent (some 4 or 5 percent). In addition, in 1960 and 1970, deficits are noticed at the adult ages (15-29 and 20-34, respectively).

Although not shown graphically, a comparison of the cumulated age distributions (the proportions under each age x, C(x-)) reveals that remarkably good fits are attained in the case of males (the proportional deviations of the observed over the estimated proportions C(x-) being generally below 2 percent above age 15), while slightly less satisfactory ones are obtained in the case of females. However, for both males and females the worst fits occur at younger ages, with the observed proportion under age 5 being underreported by as much as 10 percent in some instances. Particularly worrisome is the poor fit attained between the observed and the estimated ${}_5C_0$ in 1970 (see Figure 27) since it may imply that fertility levels for 1960-70 are overestimated. Yet, one must point out that the 1970 level of undercount at young ages implied by our fertility estimates is fairly similar to that estimated for 1940, where there is less uncertainty about the estimated fertility levels, so that it is not, in and of itself, an extraordinary outcome.

Thus, although the perfect agreement that would be desired between observed and estimated age distributions was not attained, the discrepancies observed are more likely to be caused by errors in the basic data than by the gross inadequacy of the estimated fertility and mortality levels and trends. This statement, however, should not be interpreted as meaning that the latter are free from error or that they provide completely accurate measures of the components of growth of the Brazilian population. Rather, they constitute a consistent and smooth set of estimators which help us understand the evolution of this population by approximating its most reliable features.

APPENDIX: ESTIMATED LIFE TABLES

ESTIMATED LIFE TABLES BY SEX, 1940: BRAZIL
FEMALES

AGE X	l(x)	L(x)	T(x)	E(x)
0	1.00000	0.912523	47.01434	47.014
1	0.86542	3.209517	46.10182	53.271
5	0.77409	3.824325	42.89232	55.410
10	0.75564	3.739597	39.06801	51.702
15	0.74020	3.666598	35.32841	47.728
20	0.72644	3.578174	31.66182	43.585
25	0.70483	3.464823	28.08365	39.845
30	0.68110	3.340523	24.61884	36.146
35	0.65511	3.205624	21.27832	32.481
40	0.62714	3.060972	18.07271	28.818
45	0.59725	2.904148	15.01174	25.135
50	0.56441	2.718773	12.10760	21.452
55	0.52310	2.488575	9.38882	17.948
60	0.47233	2.193424	6.90025	14.609
65	0.40504	1.821975	4.70682	11.621
70	0.32375	1.380000	2.88485	8.911
75	0.22825	0.901775	1.50485	6.593
80	0.13246	0.603074	0.60307	4.553

ESTIMATED LIFE TABLES BY SEX, 1940: BRAZIL
MALES

AGE X	l(x)	L(x)	T(x)	E(x)
0	1.00000	0.900049	44.50226	44.502
1	0.85082	3.154327	43.60222	51.247
5	0.76062	3.757324	40.44789	53.178
10	0.74231	3.675499	36.69057	49.428
15	0.72789	3.607249	33.01508	45.357
20	0.71501	3.517823	29.40784	41.129
25	0.69212	3.399873	25.89001	37.407
30	0.66763	3.271923	22.49014	33.676
35	0.64094	3.128200	19.21823	29.984
40	0.61034	2.961574	16.09004	26.362
45	0.57429	2.766800	13.12847	22.860
50	0.53243	2.533798	10.36167	19.461
55	0.48109	2.252899	7.82787	16.271
60	0.42007	1.914124	5.57497	13.272
65	0.34558	1.517474	3.66085	10.593
70	0.26141	1.085649	2.14337	8.199
75	0.17285	0.662125	1.05772	6.119
80	0.09200	0.395600	0.39560	4.300

ESTIMATED LIFE TABLES BY SEX, 1950: BRAZIL
FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)
0	1.00000	0.919933	50.25746	50.257
1	0.87682	3.292832	49.33754	56.269
5	0.79915	3.956348	46.04471	57.617
10	0.78339	3.884649	42.08836	53.726
15	0.77047	3.822675	38.20372	49.585
20	0.75660	3.745723	34.38106	45.322
25	0.73969	3.646023	30.63535	41.416
30	0.71872	3.535974	26.98933	37.552
35	0.69567	3.415575	23.45337	33.713
40	0.67056	3.284299	20.03780	29.882
45	0.64316	3.138099	16.75351	26.049
50	0.61208	2.960949	13.61541	22.244
55	0.57230	2.736249	10.65446	18.617
60	0.52220	2.441999	7.91821	15.163
65	0.45460	2.061275	5.47622	12.046
70	0.36991	1.592475	3.41494	9.232
75	0.26708	1.067325	1.82247	6.824
80	0.15985	0.755141	0.75514	4.724

ESTIMATED LIFE TABLES BY SEX, 1950: BRAZIL
MALES

AGE X	l(X)	L(X)	T(X)	E(X)
0	1.00000	0.908351	47.60881	47.609
1	0.86321	3.239133	46.70047	54.101
5	0.78578	3.889448	43.46135	55.310
10	0.77000	3.818874	39.57191	51.392
15	0.75755	3.759174	35.75305	47.196
20	0.74612	3.680398	31.99388	42.880
25	0.72604	3.570939	28.31349	38.997
30	0.70476	3.464775	24.73650	35.099
35	0.68115	3.337450	21.27173	31.229
40	0.65383	3.186975	17.93428	27.430
45	0.62096	3.005848	14.74731	23.749
50	0.58138	2.781898	11.74146	20.196
55	0.53138	2.502899	8.95956	16.861
60	0.46978	2.156000	6.45666	13.744
65	0.39262	1.738275	4.30066	10.954
70	0.30269	1.269199	2.56259	8.465
75	0.20499	0.794150	1.29319	6.309
80	0.11267	0.499037	0.49904	4.429

ESTIMATED LIFE TABLES BY SEX, 1960: BRAZIL
FEMALES

AGE X	l(x)	L(x)	T(x)	E(x)
0	1.00000	0.927083	53.89020	53.890
1	0.88782	3.372284	52.96312	59.655
5	0.82299	4.081947	49.59084	60.257
10	0.80979	4.023048	45.50890	56.198
15	0.79943	3.973274	41.48586	51.894
20	0.78938	3.912249	37.51257	47.492
25	0.77502	3.833199	33.60034	43.354
30	0.75826	3.744399	29.76715	39.257
35	0.73950	3.644374	26.02277	35.190
40	0.71845	3.532497	22.37790	31.147
45	0.69455	3.401723	18.84541	27.133
50	0.66614	3.237400	15.44370	23.184
55	0.62682	3.022973	12.20630	19.411
60	0.58037	2.734673	9.18333	15.823
65	0.51350	2.349190	6.44866	12.558
70	0.42016	1.855000	4.09951	9.760
75	0.31584	1.278074	2.24451	7.106
80	0.19539	0.966435	0.96644	4.946

ESTIMATED LIFE TABLES BY SEX, 1960: BRAZIL
MALES

AGE X	l(x)	L(x)	T(x)	E(x)
0	1.00000	0.916371	50.93271	50.933
1	0.67518	3.320105	50.01634	57.150
5	0.80974	4.015247	46.69624	57.668
10	0.79036	3.955074	42.68100	53.995
15	0.78591	3.905098	38.72533	49.274
20	0.77613	3.836749	34.82024	44.864
25	0.75937	3.752699	30.98149	40.799
30	0.74171	3.659374	27.22881	36.711
35	0.72204	3.552275	23.56944	32.643
40	0.69887	3.422475	20.01718	28.642
45	0.67012	3.259999	16.59471	24.764
50	0.63388	3.050599	13.33473	21.037
55	0.58630	2.778974	10.28413	17.539
60	0.52523	2.429025	7.50515	14.289
65	0.44638	1.993924	5.07613	11.372
70	0.35119	1.487949	3.08220	8.776
75	0.24399	0.950925	1.59425	6.534
80	0.13078	0.637330	0.63733	4.592

ESTIMATED LIFE TABLES BY SEX, 1970: BRAZIL
FEMALES

AGE X	l(X)	L(X)	T(X)	E(X)
0	1.00000	0.937952	59.24760	59.248
1	0.90785	3.519183	58.30968	64.228
5	0.86571	4.306499	54.79050	63.290
10	0.85689	4.267399	50.48401	58.915
15	0.85007	4.233348	46.21661	54.368
20	0.84327	4.188223	41.98328	49.786
25	0.83202	4.127798	37.79506	45.426
30	0.81910	4.058673	33.66727	41.103
35	0.80437	3.979098	29.60860	36.810
40	0.78727	3.885347	25.62950	32.555
45	0.76687	3.770124	21.74416	28.354
50	0.74118	3.618898	17.97404	24.251
55	0.70638	3.414874	14.35515	20.322
60	0.65957	3.132097	10.94028	16.587
65	0.59327	2.739274	7.80818	13.161
70	0.50244	2.212549	5.06891	10.089
75	0.38258	1.568850	2.85636	7.466
80	0.24496	1.287509	1.28751	5.256

ESTIMATED LIFE TABLES BY SEX, 1970: BRAZIL
MALES

AGE X	l(X)	L(X)	T(X)	E(X)
0	1.00000	0.930970	55.92941	55.929
1	0.89697	3.465721	54.99844	61.316
5	0.85271	4.240699	51.53273	60.434
10	0.84357	4.199073	47.29204	56.062
15	0.83606	4.160897	43.09297	51.543
20	0.82830	4.107299	38.93208	47.002
25	0.81462	4.037499	34.82480	42.750
30	0.80038	3.962123	30.78731	38.466
35	0.78447	3.874523	26.82520	34.195
40	0.76534	3.765149	22.95068	29.988
45	0.74072	3.621399	19.18555	25.901
50	0.70784	3.426499	15.56415	21.983
55	0.66276	3.181222	12.13765	18.314
60	0.60173	2.865149	8.97643	14.918
65	0.52033	2.496100	6.17128	11.860
70	0.41811	1.791175	3.82518	9.149
75	0.29636	1.185575	2.03400	6.817
80	0.17587	0.848430	0.84843	4.824

ESTIMATED LIFE TABLES BY SEX, 1975: BRAZIL
FEMALES

AGE X	L(X)	L(X)	T(X)	E(X)
0	1.00000	0.942594	61.99956	62.000
1	0.91370	3.591419	61.05693	66.460
5	0.88718	4.418874	57.46556	64.773
10	0.88037	4.388824	53.04669	60.255
15	0.87516	4.362073	48.65788	55.599
20	0.86967	4.324698	44.29582	50.934
25	0.86021	4.273498	39.97113	46.467
30	0.84919	4.214198	35.69765	42.037
35	0.83649	4.144850	31.48346	37.638
40	0.82145	4.061098	27.33862	33.281
45	0.80279	3.954749	23.27753	28.989
50	0.77891	3.811596	19.32278	24.807
55	0.74573	3.614823	15.51120	20.800
60	0.70020	3.337596	11.89638	16.990
65	0.63484	2.944424	8.55875	13.482
70	0.54293	2.404525	5.61435	10.341
75	0.41688	1.729025	3.20983	7.663
80	0.27273	1.480804	1.48080	5.430

ESTIMATED LIFE TABLES BY SEX, 1975: BRAZIL
MALES

AGE X	L(X)	L(X)	T(X)	E(X)
0	1.00000	0.936706	56.65576	56.656
1	0.90907	3.548739	55.71907	63.492
5	0.87616	4.363098	54.17033	61.827
10	0.86908	4.330373	49.80724	57.310
15	0.86307	4.298598	45.47687	52.692
20	0.85637	4.251549	41.17828	48.085
25	0.84425	4.189949	36.92674	43.739
30	0.83173	4.123699	32.73680	39.360
35	0.81775	4.046223	28.61311	34.990
40	0.80074	3.947673	24.56689	30.683
45	0.77833	3.814249	20.61923	26.492
50	0.74737	3.628025	16.80499	22.486
55	0.70384	3.387674	13.17697	18.722
60	0.64323	3.070399	9.78959	15.220
65	0.56093	2.640843	6.71910	12.121
70	0.45541	1.961675	4.25305	9.340
75	0.32920	1.316899	2.29138	6.960
80	0.19750	0.974410	0.97948	4.959

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GLOSSARY

AGE HEAPING A tendency for enumerators or respondents to report certain ages instead of others; also called age preference or digit preference. Preference for ages ending in 0 or 5 is widespread.

AGE PATTERN OF FERTILITY The relative distribution of a set of age-specific fertility rates. It expresses the relative contribution of each age group to total fertility.

AGE RATIO The ratio of the population in a given age group to the average of the populations in the two neighboring age groups, times 100.

AGE-SPECIFIC FERTILITY RATE The number of births occurring during a specified period to women of a specified age or age group, divided by the number of person-years-lived during that period by women of that age or age group. When an age-specific fertility rate is calculated for a calendar year, the number of births to women of the specified age is usually divided by the midyear population of women of that age.

AGE-SPECIFIC MORTALITY RATE The number of deaths occurring during a specified period to persons (usually specified by sex) of a specified age or age group, divided by the number of person-years-lived during that period by the persons of that age or age group. When an age-specific mortality rate is calculated for a calendar year, the number of deaths to persons of the specified age is usually divided by the midyear population of persons of that age. Age-specific mortality rates are generally denoted by ${}_nM_x$, the annual death rate to persons aged x to x + n.

AGE STANDARDIZATION A procedure of adjustment of crude rates (birth, death, or other rates) designed to

reduce the effect of differences in age structure when comparing rates for different populations.

BIRTH HISTORY A report of the number and dates of all live births experienced by a particular woman; see also pregnancy history. The sex of each child, the survival of each child to the date of the interview, and, where pertinent, the date of death are also generally recorded.

BIRTH ORDER The ordinal number of a given live birth in relation to all previous live births of the same woman (e.g., 5 is the birth order of the fifth live birth occurring to the same woman).

BIRTH RATE See crude birth rate.

CHANDRASEKARAN-DEMING TECHNIQUE A procedure to estimate the coverage of two independent systems collecting information about demographic or other events, based on the assumption that the probability of an event being recorded by one system is the same whether or not the event is recorded by the other system. The events from both systems are matched to establish M, the number of events recorded by both systems; U_1, the number recorded only by system 1; and U_2, the number recorded only by system 2. The Chandrasekaran-Deming formula then estimates total events, N, as

$$\hat{N} = M + U_1 + U_2 + \frac{U_1 U_2}{M}.$$

CHILDBEARING AGES The span within which women are capable of bearing children, generally taken to be from age 15 to age 49 or, sometimes, to age 44.

CHILDREN EVER BORN(E) The number of children ever borne alive by a particular woman; synonymous with parity. In demographic usage, stillbirths are specifically excluded.

COHORT A group of individuals who experienced the same class of events in the same period. Thus an age cohort is a group of people born during a particular period, and a marriage cohort is a group of people who married during a particular period. The effects of a given set of mortality or fertility rates are often illustrated by applying them to hypothetical cohorts.

COHORT FERTILITY The fertility experienced over time by a group of women or men who form a birth or a marriage cohort. The analysis of cohort fertility is contrasted with that of period fertility.

CRUDE BIRTH RATE The number of births in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as births per 1,000 population. The crude birth rate for a single year is usually calculated as the number of births during the year divided by the midyear population.

CRUDE DEATH RATE The number of deaths in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as deaths per 1,000 population. The crude death rate for a single year is usually calculated as the number of deaths during the year divided by the midyear population.

CUMULATED FERTILITY An estimate of the average number of children ever borne by women of some age x, obtained by cumulating age-specific fertility rates up to age x; also often calculated for age groups.

DEATH RATE See crude death rate.

DE FACTO POPULATION A population enumerated on the basis of those present at a particular time, including temporary visitors and excluding residents temporarily absent. See de jure population.

DE JURE POPULATION A population enumerated on the basis of normal residence, excluding temporary visitors and including residents temporarily absent. See de facto population.

DIGITAL PREFERENCE See age heaping.

DUAL RECORD SYSTEM See Chandrasekaran-Deming Technique

EXPECTATION OF LIFE AT BIRTH The average number of years that a member of a cohort of births would be expected to live if the cohort were subject to the mortality conditions expressed by a particular set of age-specific mortality rates. Denoted by the symbol e(o) in life table notation.

FERTILITY HISTORY Either a birth history or a pregnancy history.

FORWARD SURVIVAL A procedure for estimating the age distribution at some later date by projecting forward an observed age distribution. The procedure uses survival ratios, often obtained from model life tables. The procedure is basically a form of population projection without the introduction of new entrants (births) to the population.

GENERAL FERTILITY RATE The ratio of the number of live births in a period to the number of person-years-lived by women of childbearing ages during the period. The

general fertility rate for a year is usually calculated as the number of births divided by the number of women of childbearing ages at midyear.

GROSS REPRODUCTION RATE The average number of female children a woman would have if she survived to the end of her childbearing years and if, throughout, she were subject to a given set of age-specific fertility rates and a given sex ratio at birth. This number provides a measure of replacement fertility in the absence of mortality.

GROWTH RATE The increase or decrease of a population in a period divided by the number of person-years-lived by the population during the same period. The increase in a population is the result of a surplus (or deficit) of births over deaths and a surplus (or deficit) of immigrants over emigrants. (The annual increase is often expressed as a fraction of the total population at the beginning of the year, but this convention has the inconvenient characteristic of not being readily defined for a five-year interval and of being unequal to the difference between the birth rate and the death rate even in the absence of migration.) See also rate of natural increase.

INFANT MORTALITY RATE The number of deaths of children under 1 year of age occurring in the same year; also used in a more rigorous sense to mean the number of deaths that would occur under 1 year of age in a life table with a radix of 1,000, in which sense it is denoted by the symbol ${}_1q_0$.

LIFE TABLE A listing of the number of survivors at different ages (up to the highest age attained) in a hypothetical cohort subject from birth to a particular set of age-specific mortality rates. The rates are usually those observed in a given population during a particular period of time. The survivors of the radix to age x are generally denoted by l(x). The tabulations commonly accompanying a life table include other features of the cohort's experience: its expectation of life at each age x, denoted by e(x); the probability of surviving from each age x to age x + n, denoted by ${}_nq_x$; the person-years-lived by the hypothetical cohort as it ages from age x to age x + n, denoted by ${}_nL_x$ (also equivalent to the population aged x, x + n in a stationary population experiencing a number of births each year equal to the radix of the life table); and the person-years-lived

by the hypothetical cohort from age x onward, denoted by T(x).

LOGIT The logit of a proportion p is 1/2 ln[p/(1 - p)]. As a linearizing transformation, the logit has been proposed as the basis of a model life table system in which the logit of a probability of dying by age x ($_xq_o$) is related linearly to the logit of a standard probability of dying by age x ($_xq_o^s$) so that

$$\text{logit } (_xq_o) = \alpha + \beta\ [\text{logit } (_xq_o^s)],$$

where α is a measure of mortality level relative to the standard and β is a parameter that alters the shape of the standard mortality function.

MARITAL FERTILITY Any measure of fertility in which the births (in the numerator) are births to married women and in which the number of person-years-lived (in the denominator) also pertains to married women. In some instances, the designation "married" includes persons in consensual unions.

MEDIAN The value associated with the central member of a set that is ordered by size or some other characteristic expressed in numbers.

MEAN AGE OF CHILDBEARING The average age at which a mortality-free cohort of women bear their children according to a set of age-specific fertility rates.

MEAN AGE OF CHILDBEARING IN THE POPULATION The average age of the mothers of the children born in a population during a year. This measure incorporates the effects of both mortality and the age distribution.

MIGRATION RATE Number of migrants during a specified period divided by the person-years-lived of the population exposed to migration. Also see population change due to migration.

MODEL LIFE TABLE An expression of typical mortality experience derived from a group of observed life tables.

MOVING AVERAGES The successive averaging of two or more adjacent values of a series in order to remove sharp fluctuations.

MYERS INDEX An index of digit preference that essentially sums in turn the population ending in each digit over some age range, often 10-89, expressing the total as a percentage of the total population, and which avoids the bias introduced by the fact that the population is not evenly distributed among all ages by

repeating the calculations 10 times, once for each starting digit, and averaging the results. The difference between the average percentage for each digit and the expected value of 10 percent provides a measure of the preference for or avoidance of the digit over the age range considered.

NATURAL FERTILITY The age pattern of marital fertility observed in non-contraceptive populations where reproductive behavior is not affected by the number of children already born.

NET MIGRATION The difference between gross immigration and gross emigration.

NET REPRODUCTION RATE The average number of female children born per woman in a cohort subject to a given set of age-specific fertility rates, a given set of age-specific mortality rates, and a given sex ratio at birth. This rate measures replacement fertility under given conditions of fertility and mortality: it is the ratio of daughters to mothers assuming continuation of the specified conditions of fertility and mortality.

OWN-CHILDREN METHOD A refinement of the reverse-survival procedure for fertility estimation, whereby estimates of age-specific fertility rates for the recent past are obtained by relating mothers to their own children, using information on relationship and other characteristics available from a census or survey.

PARITY See children ever born.

PARTIAL BIRTH RATE The proportion of the population that enters (that is, is "born" into) a given age category in a year. The age categories used are normally open-ended, thus the partial birth rate x+ designates the proportion of the population becoming x years and older.

PARTIAL DEATH RATE The proportion of the population that leaves (that is, "dies" out of) a given age category in a year. See partial birth rate.

PERIOD FERTILITY The fertility experienced during a particular period of time by women from all relevant birth or marriage cohorts; see also cohort fertility.

P/F RATIO METHOD A consistency check for survey information on fertility. Information on recent fertility is cumulated to obtain measures that are equivalent to average parities. Lifetime fertility in the form of reported average parities by age group (P) can then be compared for consistency with the parity-equivalents (F) by calculating the ratio P/F

for successive age groups. If certain assumptions about error patterns are met, an improved estimate of fertility can sometimes be obtained by correcting the age pattern of current fertility to agree with the level of lifetime fertility reported by younger women.

POPULATION CHANGE DUE TO MIGRATION The sum of in-migrants minus out-migrants during a specified period of time. The change may also be expressed as a rate by dividing the change by person-years-lived in the population during the same period.

PREGNANCY HISTORY A report of the number and the dates of occurrence of all the pregnancies experienced by a particular woman. The outcome of the pregnancy--live birth, stillbirth, fetal death--is also recorded.

RADIX The hypothetical birth cohort of a life table. Common values are 1, 1,000, and 100,000.

RATE OF NATURAL INCREASE The difference between the births and deaths occurring during a given period divided by the number of person-years-lived by the population during the same period. This rate, which specifically excludes changes resulting from migration, is the difference between the crude birth rate and the crude death rate.

RETROSPECTIVE SURVEY A survey that obtains information about demographic events that occurred in a given past period, generally terminating at the time of the survey.

REVERSE PROJECTION See reverse survival.

REVERSE SURVIVAL A technique to estimate an earlier population from an observed population, allowing for those members of the population who would have died according to observed or assumed mortality conditions. It is used as a method of estimating fertility by calculating from the observed number of survivors of a given age x the expected number of births that occurred x years earlier. (In situations for which both fertility and mortality are known or can be reliably estimated, reverse survival can be used to estimate migration.)

ROBUSTNESS A characteristic of estimates that are not greatly affected by deviations from the assumptions on which the estimation procedure is based.

SEX RATIO AT BIRTH The number of male births for each female birth, or male births per 100 female births.

SINGULATE MEAN AGE AT MARRIAGE (SMAM) A measure of the mean age at first marriage, derived from a set of proportions of people single at different ages or in

different age groups, usually calculated separately for males and females.

STABLE POPULATION A population exposed for a long time to constant fertility and mortality rates, and closed to migration, establishes a fixed age distribution and constant growth rate characteristic of the vital rates. Such a population, with a constant age structure and constant rate of growth, is called a stable population.

STATIONARY POPULATION A stable population that has a zero growth rate, with constant numbers of births and deaths per year. Its age structure is determined by the mortality rates and is equivalent to the person-years-lived (${}_nL_x$) column of a conventional life table.

SURVIVAL RATIO The probability of surviving between one age and another; often computed for age groups, in which case the ratios correspond to those of the person-years-lived function, ${}_nL_x$, of a life table. Also called survivorship probabilities.

SURVIVORSHIP PROBABILITIES See survival ratio.

SYNTHETIC PARITY The average parity calculated for a hypothetical cohort exposed indefinitely to a set of period age-specific fertility rates.

TOTAL FERTILITY RATE (TFR) The average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates; also referred to as total fertility. It is frequently used to compute the consequence of childbearing at the rates currently observed.

UNITED NATIONS AGE-SEX ACCURACY INDEX An index of age reporting accuracy that is based on deviations from the expected regularity of population size and sex ratio, age group by age group. The index is calculated as the sum of (1) the mean absolute deviation from 100 of the age ratios for males, (2) the mean absolute deviation from 100 of the age ratios for females, and (3) three times the mean of the absolute difference in reported sex ratios from one age group to the next. The United Nations defines age-sex data as "accurate," "inaccurate," or "highly inaccurate" depending on whether the index is less than 20, 20 to 40, or greater than 40.

WHIPPLE'S INDEX A measure of the quality of age reporting based on the extent of preference for a particular target digit or digits. The index

essentially compares the reported population at ages ending in the target digit or digits with the population expected on the assumption that population is a linear function of age. For a particular age range, often 23 to 62, the population with ages ending in the target digits is divided by one-tenth of the total population, the result then being multiplied by 100 and divided by the number of different target digits. A value of 100 indicates no preference for those digits, whereas values over 100 indicate positive preference for them.

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The list should include:

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COMMITTEE ON
POPULATION AND DEMOGRAPHY

Report No. 23

The Determinants of Brazil's Recent Rapid Decline in Fertility

Thomas W. Merrick
Elza Berquo

Panel on Fertility Determinants
Committee on Population and Demography
Commission on Behavioral and
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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

Fertility and its determinants have been urgent topics for research in recent decades with the rapid expansion in world population. Attempts to control population growth have focused on reducing fertility, with some apparent effect. The peak rate of growth in the world's population has now been passed, but growth is still at a high level in almost all the developing countries. In absolute numbers, the increase in the world's population continues to rise; according to United Nations medium projections, more people will be added each year for the next 50 years than were added in 1980.

This report is one of a series of country studies of fertility determinants carried out by the Panel on Fertility Determinants of the Committee on Population and Demography. The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and

trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the committee was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee concentrated its initial efforts on the first two tasks. This work is detailed in a series of country and methodological reports from the National Academy Press, and the demographic estimation methodology developed for the country studies is laid out in a volume issued by the United Nations. Altogether, some 170 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee initiated work on the third task in October 1979 when the separately funded Panel on Fertility Determinants was established. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the Panel on Fertility Determinants includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel. The work program of the panel includes the preparation of a report that attempts to summarize and integrate scientific knowledge about the

determinants of fertility (Academic Press, 1983) as well as a few illustrative cross-national analyses and studies of several developing countries (see inside back cover).

This report is the fourth panel country study. It has been prepared by Thomas W. Merrick, director, Center for Population Research, Georgetown University, and Elza Berquo, research scholar, Centro Brasileiro de Analise e Planejamento, Sao Paulo, Brazil, and a member of the panel. Although it is self-contained, the study is in part a companion to the report of the committee's Panel on Brazil, Levels and Recent Trends in Fertility and Mortality in Brazil, published earlier this year, which examines some of the demographic estimates that are incorporated in this report. Thomas Merrick served as a member of the Panel on Brazil.

The work on this study was carried out at Georgetown University and at the Centro Brasileiro de Analise e Planejamento. During its preparation, each author spent time at the other's institution and at the committee office. Both of the authors' institutions provided logistical support, and, more important, each institution essentially supported each author during the time they devoted to the preparation of this report. The panel and the committee are grateful to these institutions for all of this support.

Partial financial support for research assistance and computer use also was provided through an award from the Rockefeller and Ford Foundations' Research Program on Fertility, Mortality, and Development Interrelations. For Part I of this report, Mahesh Sharma provided capable programming and statistical assistance, and Pamela Nall made valuable contributions to the preparation of tables and in typing material for the report. For Part II, Marcelo Cesar Gouveia and Ivaldo Olimpio da Silva assisted in programming, Rebecca de Souza e Silva provided statistical assistance in preparing tables, and Oneida Maria Borges deserves credit for typing draft material for the report. Jose Alberto Magno de Carvalho, Hania Zlotnik, and Leo Morris provided comments and technical advice at various stages. Brazil's IPPF affiliate, BEMFAM, and the U.S. Centers for Disease Control were particularly helpful in providing information and advance copies of tables from the Contraceptive Prevalence Surveys cited in the report.

An early version of the draft report was discussed at a country studies workshop organized by the panel in

January 1982 with financial assistance from the Rockefeller Foundation. Finally, panel and committee reviewers provided advice and suggestions.

Several members of the panel and committee staff assisted in the preparation of this report. On the production side appreciation is expressed to Elaine McGarraugh of the panel staff for handling the production editing details, to Solveig Padilla and Irene Martinez for helping type the text and tables, and to Rona Briere for editing the report.

W. PARKER MAULDIN, Chair
Panel on Fertility Determinants

SUMMARY

Brazil experienced very rapid decline in fertility during the 1970s. Both the crude birth rate and more refined fertility measures such as the total fertility rate dropped by 25 to 30 percent during the decade; this represented a threefold acceleration in the pace of fertility decline over the previous decade. By 1980, Brazil's crude birth rate was close to 30 per 1,000, as compared to over 40 per 1,000 in the mid-1960s. Total fertility was close to 4.0, a decline of nearly two births per woman from the level of 5.8 births observed in the late 1960s. As shown in Figure 1, the decline was experienced in both rural and urban areas, as well as all of Brazil's major regions, including the Northeast, where fertility rates have traditionally been very high (see Figure 2). In Sao Paulo and other southern states, fertility had declined starting in the 1950s, but the pace accelerated after 1965.

The objective of this report is twofold: (1) to examine this accelerated fertility decline in light of changes in the proximate determinants of fertility; (2) to relate these latter changes in turn to socioeconomic changes that might account for the accelerated decline. The available data on which this report is based are limited in their geographic representation, their timeliness for measuring change, and their coverage of relevant demographic and socioeconomic variables, as well as their reliability in measuring the variables that are included. Despite these limitations, however, the available evidence provides strong support for the following hypotheses: (1) that declining marital fertility was the main demographic component of the accelerated decline; (2) that the principal proximate determinant of this decline consisted of increased fertility control within

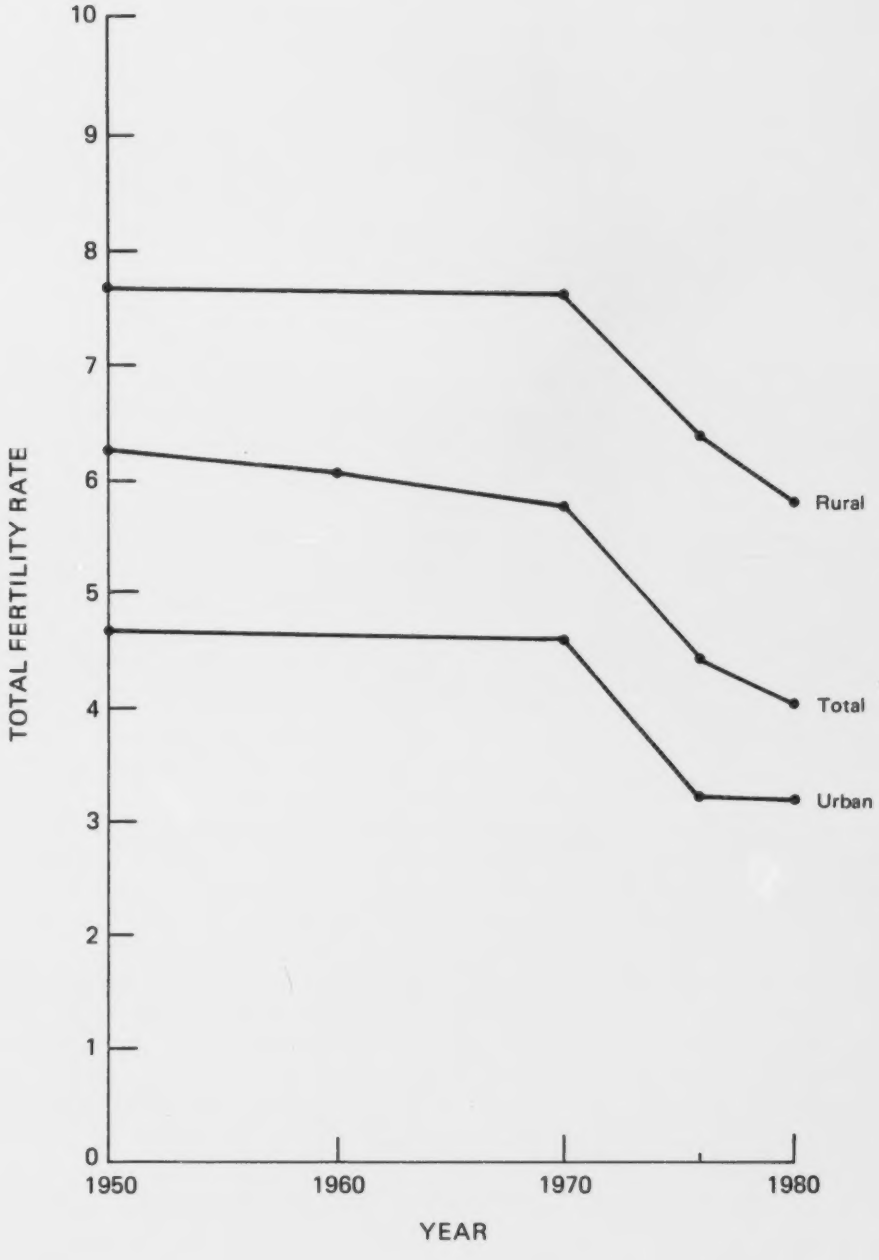

FIGURE 1 Total Fertility Rates by Urban-Rural Residence, 1950-80: Brazil

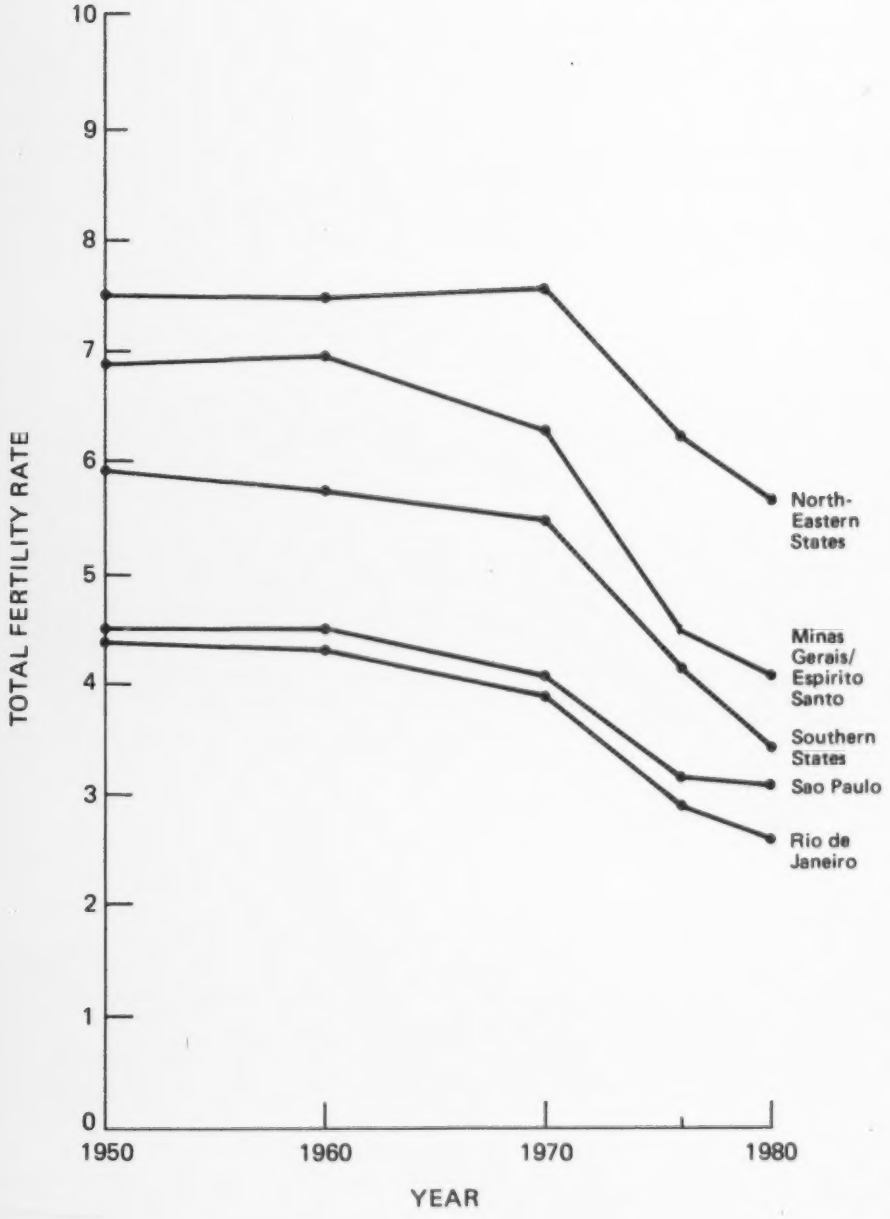

FIGURE 2 Total Fertility Rates by Region, 1950-80: Brazil

marriage (contraception, sterilization, and abortion), though it was not possible to specify precisely what the "mix" of these determinants was or how it may have changed; (3) that the decline in marital fertility can be attributed mainly to the spread of fertility control to lower-income regions and groups that had not participated in previous fertility declines; and (4) that these groups experienced socioeconomic changes (for example, increased educational attainment, increased ownership of such consumer durable goods as televisions, and increased female labor force participation) that were conducive to smaller family norms.

This report is based mainly on three sources of information. The first consists of national-level data collected by the Brazilian census bureau (Fundacao Instituto Brasileiro de Geografia e Estatistica--FIBGE), including the 1970 population census and a 1976 national sample survey (Pesquisa Nacional por Amostra de Domicilios--PNAD). Both included retrospective questions on fertility as well as on socioeconomic characteristics. The second source is the state-level Contraceptive Prevalence Surveys (CPS) conducted during the late 1970s by Brazil's International Planned Parenthood affiliate, BEMFAM (Sociedade Civil de Bem-Estar Familiar), with the assistance of the U.S. Center for Disease Control. Finally, a source at the local level is the CEBRAP National Investigation of Human Reproduction (NIHR), which consists of in-depth contextual studies of nine communities representing different types of socioeconomic structure in Brazil, as well as small sample surveys of the reproductive life histories of women in those settings. When possible, other sources are used to provide supplemental information.

The report is presented in two parts. The first uses the national- and state-level data to examine several hypotheses about how socioeconomic changes may have influenced the reproductive behavior of different groups in Brazil during the early 1970s. Tabular and multiple regression analyses of these data provide strong support for the argument that increased educational attainment of women contributed to the modernization of reproductive behavior, though the data do not provide enough information to specify precisely how this occurred. Nor do they permit as full a testing as one would desire of hypotheses about the way in which institutional forces and structural factors arising from class differences and economic pressures influenced reproductive patterns. The second part

of the report consists of a detailed examination of the NIHR local-level data, providing a more focused perspective on Brazilian fertility patterns. These contextual data reveal a wide range of institutional forces that may have influenced fertility. However, the task of establishing the links between these factors and patterns of individual reproductive behavior reported in the sample survey component of the NIHR is still to be completed. The major conclusions of the report are summarized below.

THE PROXIMATE DETERMINANTS OF FERTILITY

The available evidence indicates that changes in the distribution of women by marital status, either through changes in the mean age at marriage or through increases in the proportion of women remaining single, was not a major factor in Brazil's accelerated fertility decline during the 1970s. This is a guarded conclusion because the data on marital status in Brazil are clouded by questions about their reliability, and about the effect of changes in reporting procedures. The most serious problem relates to consensual unions, particularly the extent to which true changes in the proportion of such unions and/or changes in their reporting affected measurement of the mean age at marriage. Because of doubts about mean age at marriage as an index of the effect of changes in marital status on fertility, an alternative measure--mean age at first birth--was also calculated. This measure indicated that changes in age at first birth (which is the main way that changes in age at marriage would affect fertility) did not contribute significantly to the accelerated fertility decline between 1970 and 1976. Thus the report concludes that declining marital fertility (with "marital" including both formal and informal unions) was the main contributor to Brazil's fertility decline. Among the major proximate determinants of marital fertility, the report draws the following conclusions.

Breastfeeding: Postpartum amenorrhea resulting from extended breastfeeding has contributed to fertility reduction in some populations; however, there is no evidence to suggest that changes in breastfeeding patterns played a major role in Brazil's accelerated fertility decline. Indeed, because the practice of breastfeeding is very limited in Brazil, it is difficult

to fit models linking mean duration of breastfeeding and postpartum amenorrhea to Brazilian data.

Contraception: Increased control of marital fertility played a major role in Brazil's accelerated fertility decline (see Figure 3). Since there were no nationally representative "before" and "after" data by which to measure changes in contraceptive use, this conclusion is based on fragments of "circumstantial" evidence. This includes the state-level Contraceptive Prevalence Surveys, as well as information on the production and distribution of contraceptives through public- and private-sector institutions and commercial channels. The main unanswered question relates to the mix of fertility control means involved in this increase. The 1970s brought a dramatic increase in the production and distribution of pills in Brazil, and the surveys also report a high rate of surgical sterilization.

Abortion: The main unknown in the mix of fertility control in Brazil is abortion. While survey data reveal comparatively few abortions, the practice is reportedly widespread. Assuming that abortion and contraception were substitutes in the mix of fertility control measures actually used, the report uses a range estimate for the prevalence of abortion. The main flaw in this logic is that while most births in Brazil occurred among women in unions, a higher proportion of pregnancies may have been terminated by abortion among women who were not in unions.

DETERMINANTS OF FERTILITY DECLINE

Brazil's accelerated fertility decline coincided with a period during which lower- and middle-income urban households were raising their consumption expectations. They were also beginning to realize these expectations through increased purchases of housing and other consumer durables, including televisions and automobiles, with most purchases made on the installment plan. Because of unequal treatment of wages and credit obligations in Brazil's indexing system, it was more difficult for families to keep up with payments, and even to purchase basic necessities during periods of high inflation. A working hypothesis is that this pattern, combined with increased knowledge of and access to contraception, may have altered reproductive strategies and/or reduced

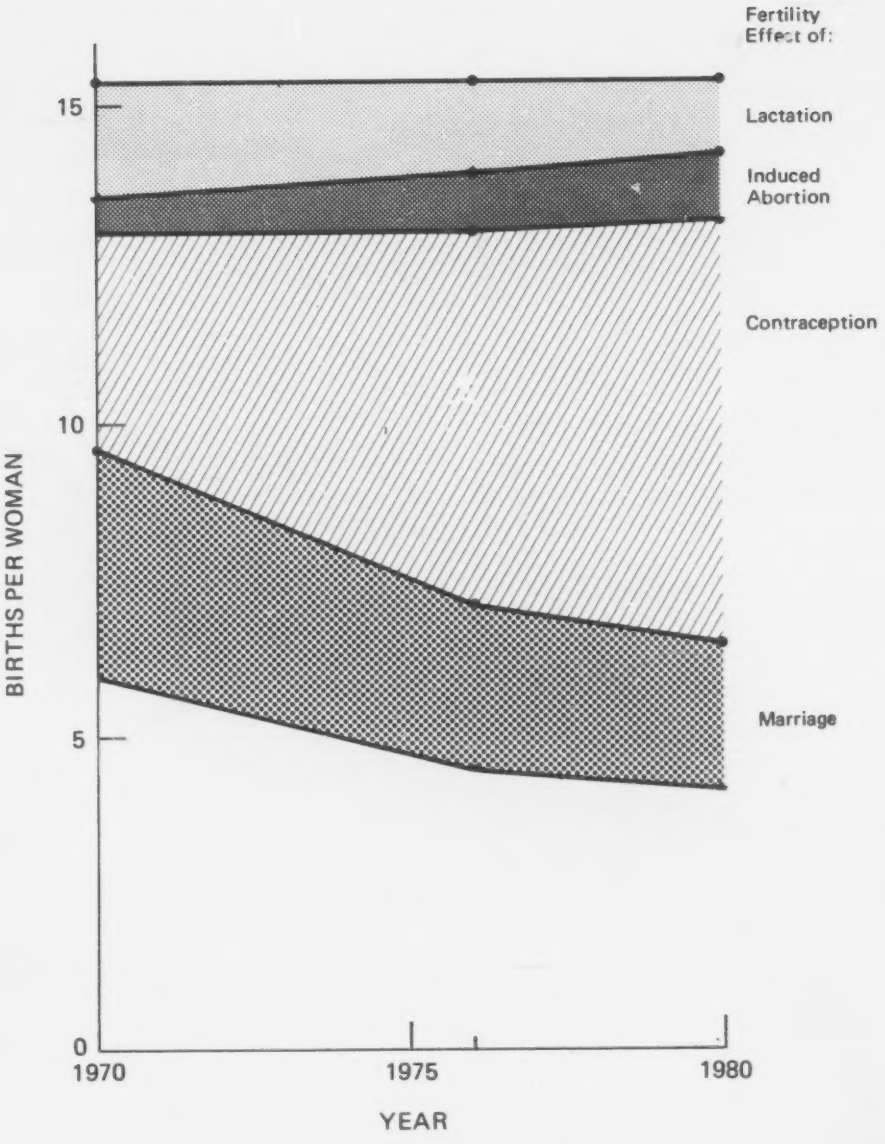

FIGURE 3 Changes in Selected Reproductive Measures Based on Bongaarts' Model, 1970-80: Brazil

family-size desires. While income was an important covariate of contraceptive use, survey evidence suggests that lower income women are also controlling fertility, particularly in the higher income southern region and in states that have established community-based family planning programs (see Figure 4). This explanation does

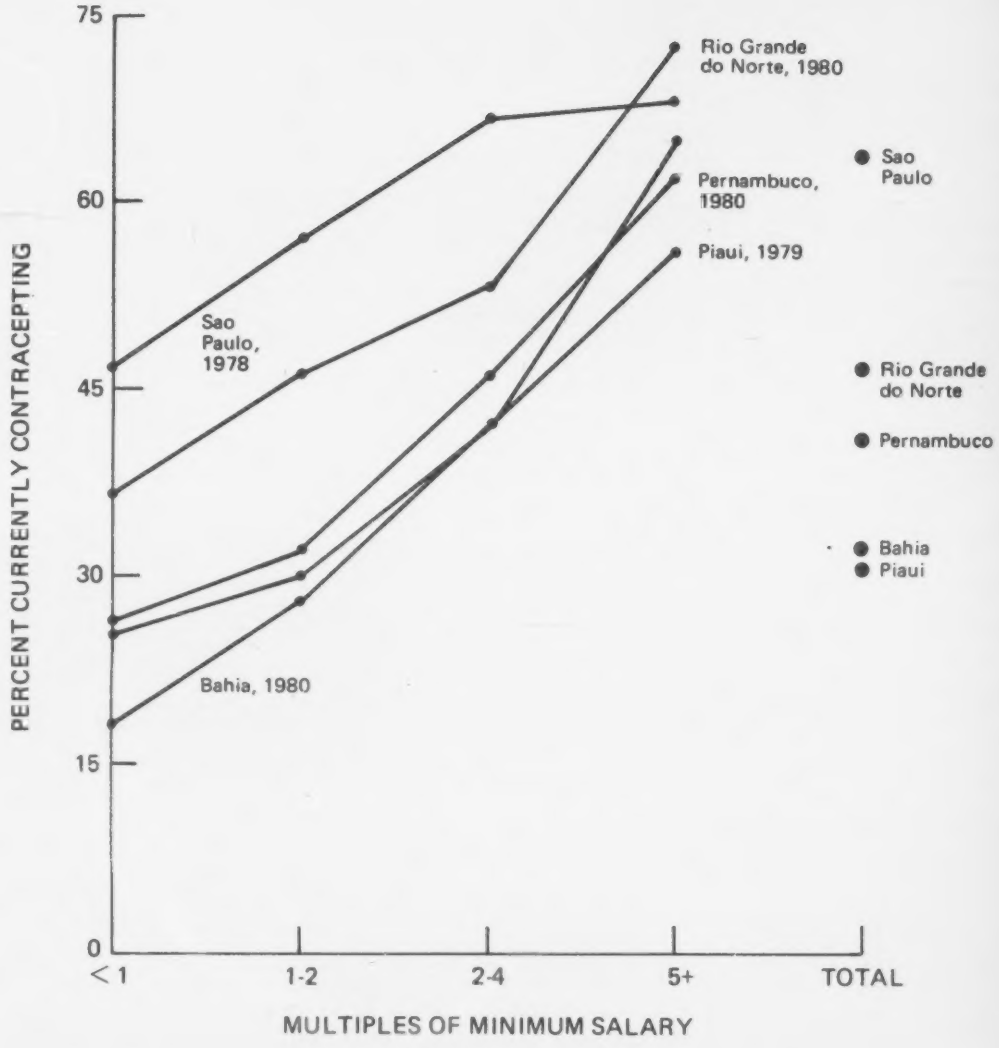

FIGURE 4 Percent of Married Women Aged 15-44, Currently Using Contraception, by Household Income for Specified Years: Brazil

not compete with more conventional explanations of fertility decline as part of the process of modernization, but is an extension incorporating other structural changes.

Part I of this report presents a three-step examination of these hypotheses. The first step consisted of calculating fertility rates based on reports of children

ever born and children born in the year prior to census and survey interviews for women classified by income and education levels. These calculations revealed that fertility decline was greatest between 1970 and 1976 among urban lower- and middle-income women, and that increases in educational attainment among these women was a potentially important contributor to that decline. The calculations also raised questions about the interpretation of reports of recent births in the analysis of subgroup differentials, suggesting that the analysis be limited to data on children ever born.

The second step consisted of cross tabulations (controlling for differences in educational attainment) of 1970 and 1976 data on children ever born with questions relating to the hypotheses described above. Specific topics for the latter included female labor force participation, ownership of televisions, migration, and, for rural women, increases in the proletarianization of rural labor.

The third step consisted of multiple regression analysis of the data on children ever born. Among the research questions addressed in this analysis were the following: (1) What measures in the available data files could be used as appropriate indices of the modernizing forces and economic pressures discussed above? (2) How could the relation between these measures and average parity be specified? Were the relationships linear? Should interactions be taken into account? (3) Could the analysis be pushed beyond explanation of differentials in average parity in 1970 and 1976 to an assessment of the sources of changes in fertility during that interval? In other words, did declines in average parity reflect changes in the composition of the population of married women according to modernizing characteristics, or changes in the parameters reflecting the impact of these variables on parity? The latter are likely to reflect structural changes; one of the goals of the analysis was to incorporate variables in the specification for which such changes would be indicative of the specific structural forces hypothesized above, that is, increased economic pressures on household resources.

Most of the variation in average parity (CEB) that could be explained by multivariate regression analysis of data on individual married women from the Brazilian census and PNAD survey related to modernization variables, education, and average earnings. Most of the change that could be accounted for between 1970 and 1976 related to

increases in educational attainment and earnings. An attempt to incorporate a variable measuring the relative economic position of urban households (GAP) indicated that there was a positive association between fertility and relative economic status; that is, CEB was higher on average for women whose husbands' current earnings exceeded the level that would be expected given their education and other characteristics. However, decomposition of changes in CEB from 1970 to 1976 did not show that change in GAP contributed to fertility decline.

These regression results do not suggest that increased modernization was the only reason for change. Changes in regression coefficients and in constant terms in the regression equations suggest that a variety of unmeasured factors could have contributed to unexplained variance. Measures that were available in the census and survey data file provide little insight into the nature of such changes--whether they were related to increased access to contraception through public or private channels, or to institutional changes associated with shifts in the Brazilian model of social and economic development.

The nine local studies of the NIHR examined in Part II cover a range of economic and social contexts, including Sao Jose dos Campos's (Sao Paulo State) concentrated industrial capitalistic mode of production, an area in Rio Grande do Sul where small owner-operated establishments predominate, and traditional latifundia-dominated production in the Northeast. Institutional variations were found to be reflected in reproductive behavior in a number of ways, including wide differences in both fertility levels and the proximate determinants of fertility. However, despite major differences in fertility patterns among the different contexts, all but one (Parnaiba-Rural in the Northeast) experienced a significant fertility decline during the early 1970s. CEBRAP's research has not progressed to the point of linking macrostructural differences and changes to recent fertility declines. However, the common experience of the different contexts suggests that societal--rather than local-level influences have contributed to the recent acceleration of fertility decline.

Consensual unions represent a higher and apparently increasing proportion of unions in Recife and other Northeastern contexts; this fact may have contributed to the lower age at marriage and higher fertility observed in those contexts. However, as in Part I, the major determinant of fertility decline is identified as

declining marital fertility. Again as in Part I, the main proximate determinant of this decline in marital fertility was found to be increased use of contraception, particularly the more effective methods. This can in turn be related at the local level to shifts in family income: as in Part I, it is concluded that there is a positive association between higher family income and decreased family size.

INTRODUCTION

BACKGROUND

Brazil accounts for one-third of the population of Latin America, and nearly half that of South America. Its land area occupies 48 percent of the subcontinent, and is about equal in size to the United States, excluding Alaska. The population in 1980 was 120 million, more than double the 1950 total of 52 million. Starting in the late nineteenth century, Brazil experienced population growth rates in excess of 2 percent per annum, with a peak period of nearly 3 percent during the 1950s. Since then, the rate of growth has declined, and now stands at about 2.2 percent. Recent CELADE population projections, which incorporate new information on declining growth rates, indicate a population of about 185 million for Brazil in the year 2000; this means that about one-third of the increase in Latin America's population between now and the end of the century is expected to occur in Brazil.

Geography and Population Distribution

Brazil's geographic position, straddling the equator, has endowed it with both tropical and subtropical climates. Rainfall, latitude, and altitude contribute to the observed climatic conditions, ranging from very hot most of the year in the tropical rain forests of the Amazon region to chilly and damp during the Southern winters. A high plain (the planalto) encompassing much of the central Brazilian land mass is ridged by several low mountain chains running in a generally southwest to northeast direction. The first of these chains is the

coastal escarpment that divides the relatively narrow coastal plain from the interior. Bordering the planalto are two large basins that spread out over the territory fed by Brazil's main river systems: the Amazon and its tributaries, which cut a wide path as they flow from west to east just below the equator, and the Parana system, which flows from north to south to become the Plata River dividing Argentina and Uruguay. A wide band of lands, starting at the northeast coast and jutting into the interior in a southwesterly direction, is known as the sertao, a semiarid high plain that has suffered many severe droughts.

Overall population density is low--14 persons per square kilometer. However, this figure is deceptive because of the high population density of the coastal regions and the very low density of the interior. This coastal concentration has decreased in recent decades because of internal migration both to rural areas and to cities on the agricultural frontier. Brazilian geographers have divided the country into five major regions for purposes of social and economic description (see map). The most populous of these regions is the Southeast, which accounts for 43 percent of the national total. Although it occupies only 11 percent of Brazil's land area, it includes the major urban-industrial centers, including Rio de Janeiro, Sao Paulo, and Belo Horizonte. This region dominates Brazil economically in all sectors, including agriculture; per capita income is half again as large as the national average. The second most populous region is the Northeast, with 29 percent of the total population and 18 percent of the land area. This is Brazil's poorest region, with a per capita income less than half the national average. Periodic droughts in its sertao region have contributed to its persistent rural poverty. A third region, the South, holds 16 percent of Brazil's population and is comparatively prosperous. It is endowed with good agricultural land, but has less industry than the Southeast. Droughts and frosts devastated large areas of the region during the 1970s, leading to substantial out-migration of rural families that had settled there during the 1950s and 1960s. The two remaining regions, which constitute Brazil's vast interior, have experienced substantial in-migration during the last two decades. The Central-West, with 22 percent of the land area, increased its share of total population from 3 to 6 percent from 1950 to 1980. The new national capital, Brasilia, is located there. The

RORAIMA
AMAPA
MARANHAO
CEARA
Fortaleza
Manaus
Belem
RIO GRANDE DO NORTE
North
AMAZONAS
PARA
Northeast
PARAIBA
PERNAMBUCO
PIAUI
Recife
ACRE
ALAGOAS
RONDONIA
GOIAS
BAHIA
SERGIPE
Central-West
DISTRITO FEDERAL
Salvador
MATO GROSSO
Brasilia
MINAS GERAIS
Belo Horizonte
ESPIRITO SANTO
Southeast
SAO PAULO
RIO DE JANEIRO
Rio de Janeiro
PARANA
Sao Paulo
Curitiba
South
SANTA CATARINA
RIO GRANDE DO SUL
Porto Alegre
Boundaries
International
Regional
State
Titles
Regions (bold)
STATES
Contexts

North, or Amazon, region occupies the largest part of Brazil's land area (42 percent) and is the least populated region (5 percent of the total). Although ambitious (and unrealistic) plans to resettle large numbers of poor farmers from the Northeast have been scaled down, hundreds of thousands of rural migrants from the South, Southeast, and Central-West regions flooded the territory (now a state) of Rondonia during the 1970s.

Political and Economic History

Brazil was first settled during the sixteenth century by the Portuguese who came in search of the gold that lured the Spanish conquistadores; however, they had to satisfy themselves with tropical agricultural production along the Northeastern coastal plain. A sequence of boom-bust export cycles punctuated the colonial period, beginning with brazilwood. Sugar production dominated the seventeenth century. The plantation system on which it was based required many unskilled laborers, and with no indigenous population to exploit, the Portuguese turned to the African slave markets. During the four centuries of the Atlantic slave trade, Brazil accounted for 36 percent of the total slave imports. The colonial heritage of the slave-based plantation system left a mark on the Northeast that even today is an important feature of its cultural diversity and economic backwardness.

During the eighteenth century, the Northeast drifted into economic stagnation; the center of gravity of the world sugar economy shifted to the Caribbean, while the Brazilian economy came to be dominated by gold and diamonds, which were discovered in Minas Gerais and Goias. Slaves were also employed in mining. Conflicts with Portugal over taxes on gold production, combined with the weakening of Portuguese power during the Napoleonic Wars, led to independence during the early nineteenth century.

During the nineteenth century, a new export cycle emerged, based on coffee and dominated by the state of Sao Paulo. Initial attempts to employ slave labor in coffee production proved unsatisfactory and slavery was eventually abolished. Paulista planters encouraged immigration, predominantly from Italy. These immigrants were able to secure better living conditions and a share of coffee profits; in fact, upwardly mobile immigrants and their offspring emerged as the urban industrial and entrepreneurial classes during Sao Paulo's industrialization in the twentieth century.

The two world wars and the Depression revealed the liabilities of dependence on exports for economic well being. As a consequence, Brazil adopted an import-substituting industrialization strategy during the 1950s. Brazil was more successful than many developing countries in establishing domestic manufacturing; it had achieved relative independence in nondurable goods even before World War II, and moved rapidly toward autonomy in durables and capital goods thereafter. However, the success of import substitution also brought problems: increased regional inequality because of the concentration of industrial activity in the Southeast; limited labor absorption because of the comparative capital intensity of imported manufacturing processes; increased dependence on foreign capital and petroleum (which Brazil has to import); and aggravated inequality in the distribution of income between those who benefited from the manufacturing boom and the growing masses of unskilled workers who migrated to the cities hoping to find greater opportunities.

Import substitution coincided with the period in which Brazil experienced its most rapid increase in population. Despite population growth rates of nearly 3 percent, per capita income grew at an average annual rate of around 5 percent, to stand at a level of about $1,600 by the late 1970s. This put Brazil near the top of so-called middle-income developing countries. However, as noted above, this national average masks major inequity in the distribution of income, among regions as well as among individuals and households. In 1972, the top 10 percent of households accounted for over 50 percent of household income, while the lowest 40 percent of households received only 7 percent. These differentials are echoed in other measures of welfare, such as infant mortality, access to public services, and housing conditions. While rapid population growth did not cause these problems, it surely aggravated them and does not make the task of overcoming them any easier.

The postwar period also brought rapid urbanization, as well as concentration of the urban population in large cities. The urban population increased from 36 percent of the total population in 1950 to 67 percent in 1980. The rural population declined in absolute terms between 1970 and 1980. The state of Sao Paulo (21 percent of Brazil's total population) is now 90 percent urban; the population of metropolitan Sao Paulo was 12.6 million in 1980, more than half of the state population.

Changes in Brazil's social and economic structure, combined with increased inflation and unemployment as the initial momentum of import substitution subsided, brought political turmoil and led to a military takeover in 1964. The military has traditionally played the role of arbiter in Brazilian politics, but their last intervention has been the most pervasive. Although there is currently a movement toward a return to civilian rule, the path is far from clear. Economic problems that have plagued Brazil since the mid-1970s and that dominate the current economic and political arena may play a key role. During the late 1960s, a combination of hard-handed military rule and civilian technical expertise restored stability to the Brazilian economy, with annual growth of industrial output exceeding 10 percent. One price for this stabilization program was deterioration of the earning power of lower-income groups; another was increased foreign debt. Then came the energy crisis, which inflated the cost of almost everything that Brazil imported, including the oil on which the economy was heavily dependent. Increased borrowing has put Brazil at the top of the list of indebted countries with a debt of over $60 billion; the cost of managing this debt adds further to balance-of-payments and inflationary pressures.

While social programs have not been a top priority of the military governments, they have not been neglected. During the past two decades, Brazil has invested in ambitious programs to increase access to public services and education, with a steady and sometimes impressive progress. Enrollment of the primary school population increased from 54 percent in 1955 to 85 percent in 1974, and secondary enrollment ratios rose from 3.7 percent in 1960 to 16.6 percent in 1976. The government has also sponsored a large-scale adult literacy program, as well as other types of adult education. Coverage of the urban population by social insurance (which includes basic health services) increased from 43 percent in 1960 to 79 percent in 1975. A National Housing Bank was established to finance low-income housing and urban services. Access to piped water in urban areas increased from 16 percent in 1950 to 68 percent in 1976, with much of the increase coming after 1970 under a national water and sanitation program. The cost of these programs has put further strain on the government budget; payroll taxes were recently increased to ease this budget pressure, exacerbating political tensions.

RECENT DEMOGRAPHIC TRENDS

Population Trends

At the beginning of the nineteenth century, the Brazilian population numbered about three and one-third million; two million were either slaves or former slaves who had been manumitted. By 1900, the population was nearly 18 million, with recent European immigrants representing an increasingly important group. Cultural and ethnic diversity, an important dimension of the Brazilian social structure, has proved difficult to measure in standard statistics. Complex patterns of interracial marriage and self-declaration of race in four categories (white, black, yellow, and mixed) in Brazilian censuses led to such skepticism about the validity of the data that the question was abandoned in 1970. Though the question was reintroduced in 1980, there is a major void in data on the ethnic aspects of Brazil's recent demographic history.

The demographic components of Brazil's population increase since 1940 are summarized in Table 1, which presents estimates of crude birth and death rates and the rate of population growth. The table indicates an increase in average annual growth rate from 2.39 percent in the 1940s to 2.99 percent in the 1950s. This resulted from the combination of a virtually constant birth rate and a 30 percent decline in the death rate, along with a limited amount of immigration. The growth rate declined slightly during the 1960s, and more rapidly during the 1970s; the reason for this accelerated decline during the 1970s was a more rapid decline in the birth rate of about 17 percent from 1960-70 to 1970-80.

TABLE 1 Components of Population Growth, 1940-80: Brazil

Period	Average Annual Rate of Population Increase	Crude Birth Rate	Crude Death Rate	Rate of Natural Increase
1940-50	2.39	44	20	24
1950-60	2.99	43	14	29
1960-70	2.89	41	13	28
1970-80	2.48	34	9	25

Sources: 1940-70 from Merrick and Graham (1979:Table III.5); 1970-80, see text.

As with other features of Brazilian economic and social history, these national-level data mask important regional differentials. The pace of change in both mortality and fertility has varied substantially between the more urbanized Southeast and the rest of Brazil, most strikingly in comparison with the Northeast. Both the level and timing of such regional differentials can be clarified by more refined measures of fertility and mortality, the total fertility rate, and the expectation of life at birth.

The main sources of national- and regional-level data on fertility and mortality rates in Brazil are the decennial censuses and the national sample survey program (Pesquisa Nacional por Amostra de Domicilios--PNAD). Though Brazil started to collect vital statistics at the national level in 1974, coverage is still not adequate to permit assessment of national levels and trends (Altmann and Ferreira, 1979). However, starting with the 1940 census, Brazil began reporting the number of children ever born and the number of children surviving by age of mother. A question on the number of births in the year prior to the interview was added in the 1970 census, and was continued in sample surveys taken in 1972 through 1975. In 1976, this question was modified to specify the date of the last live birth, a procedure that was also used in the 1980 census (see Leite, 1981:Table 1). Brazilian demographers, and more recently the Panel on Brazil of the Committee on Population and Demography, National Academy of Sciences, have derived estimates of fertility and mortality from these data using indirect estimating techniques. The panel based its estimates on the census data for 1940-70 and the PNAD survey data thereafter. As the present report was being written, preliminary tabulations of the 1980 census became available. These tabulations are based on an approximately one-percent sample of questionnaires processed in advance of the definitive tabulations, which are scheduled to appear on a state-by-state basis. Where possible, estimates based on these preliminary results are introduced. The Panel's fertility and mortality estimates for 1950-76 are reported in Tables 2 and 3, and detailed discussion of data sources and measurement techniques is presented in their report (National Academy of Sciences, 1979).

National and Regional Trends in the Total Fertility Rate

Table 2 presents data on national and regional trends in total fertility rates. The PNAD samples, which are the only source of regional data during the 1970-80 intercensal interval, are based on a somewhat different regional breakdown than the one described above because of sampling requirements. There are seven PNAD regions: the Amazon and Central-Western regions are combined in a region referred to as Frontier States (7), though only their urban population is included in the PNAD surveys; Brasilia is a separate region (6); Rio de Janeiro (1), Sao Paulo (2), and Minas Gerais/Espirito Santo (4) are broken out of the Southeastern group and reported as separate regions; and the Northeastern (5) and Southern (3) regions are maintained. For consistency, the report of the Panel on Brazil regrouped census data into PNAD regions, which are also shown in Tables 2 and 3.

At the national level, total fertility was nearly constant prior to 1960, and declined by about 6 percent during the 1960s. There was a marked acceleration in fertility decline during the 1970-76 interval, when total fertility fell by 24 percent, although the indirect measures make it difficult to determine when the acceleration actually started. The report of the Panel also

TABLE 2 Total Fertility Rates, 1950-80: Brazil and PNAD Regions

Region	1950	1960	1970	1976	1980
1. Rio de Janeiro	4.42	4.34	3.91	2.92	2.65
2. Sao Paulo	4.52	4.49	4.07	3.17	3.13
3. Southern States	5.96	5.75	5.48	4.20	3.47
4. Minas Gerais/ Espirito Santo	6.90	6.98	6.31	4.54	4.11
5. Northeastern States	7.52	7.50	7.58	6.30	5.71
6. Brasilia	--	--	5.52	3.83	3.63
7. Frontier States	7.14	7.32	7.08	--	5.07
Brazil: Total	6.32	6.18	5.83	4.44	4.10
Urban	4.68	--	4.61	3.48	3.47
Rural	7.70	--	7.71	6.36	5.83

Note: -- indicates that data were not available.

Sources: National Research Council (1983). Estimates for 1950 and 1960 are based on Carvalho's (1973) variant of the Brass method, which utilized the P/F ratio for women aged 20-29 as discussed in the text; estimates for 1970, 1976, and 1980 are based on National Academy of Sciences' variant of the Brass method, which employs the average of P/F ratios for women aged 20-24 and 25-29.

provides estimates of total fertility based on the own-children method which suggest that total fertility in 1969-70 was lower than 5.8. In all likelihood, the decline in the national total fertility rate accelerated in the late 1960s.

This national trend once again masks major regional differentials. The transition to lower fertility was already well underway in Rio de Janeiro and Sao Paulo during the 1950s, with total fertility nearly 2 children per woman lower than the national average by 1970. A more gradual decline was underway in the Southern states and in Minas Gerais/Espirito Santo. In contrast, fertility in the Northeast and in the Frontier states was high, possibly increasing, before 1970. Regional differentials increased during the 1950-70 period, but declines in the Southeast were not great enough to have a significant impact on the national trend. In the rural-urban breakdown, there was little change from 1950 to 1970 in either; this suggests that the limited national decline resulted in large part from the increased weight of the urban population in the total.

The 1970-76 period brought accelerated declines in all regions. In the Southern and Southeastern regions, rates fell by 22-28 percent, with the greatest decline occurring in region (4) (Minas Gerais/Espirito Santo). While the decline in the Northeast was less--17 percent--it signaled an important increase in the spread of accelerated fertility decline. At the same time, the Northeast-Southeast differential increased. Since rates of decline in the Southeastern states have reached comparatively low levels, continuation of the national trend will depend to a large extent on the pace at which Northeastern states catch up.

Estimates based on preliminary tabulations of the 1980 census indicate that the trend observed for the 1970-76 period continued during 1976-80, though at a slower pace. The 1980 total fertility rate for Brazil, 4.11, is 7.7 percent less than the 4.44 recorded in 1976 and 29.7 percent less than the 1970 rate of 5.83. Total fertility in the Southern region declined most (17.7 percent) during 1976-80, making this the region with the largest overall decline (36.7 percent) over the decade. Region (4) (Minas Gerais/Espirito Santo) ranked second in 1976-80, with 9.5 percent, and also second for the decade, with 34.9 percent. It is significant that the Northeast, which ranked last during the 1970-76 interval, was third in 1976-80 with a 9.4 percent decline, since this suggests that the spread of fertility decline to the

Northeast has continued and even accelerated. For the decade, this put the Northeast just ahead of Sao Paulo, which had a very small decline (1.3 percent) during 1976-80 and ranked last for the decade with 23.1 percent. Both Rio de Janeiro and the Frontier states were within a point or two of the national average, suggesting that omission of rural areas of the Frontier from the 1976 results probably did not bias the rate reported for Brazil at that date.

A surprising feature of the 1980 results is that they indicate that fertility decline during the 1976-80 period was limited to rural areas; total fertility for urban areas was practically unchanged over that interval. This raises a number of questions, to which the limited data published in the preliminary tabulations provide very few answers. One of these questions relates to the reliability of the sample frame on which the 1976 survey was based. It may be that the "Brazil" sampled in the 1976 survey underrepresented groups that experienced slower fertility decline, leading to an overstatement of the decline from 1970 to 1976 and an understatement of the decline from 1976 to 1980. If this was not the case, there is an even more interesting question of why urban fertility decline accelerated (to 24.5 percent) during the early 1970s and dropped to zero at the end of the decade. Was there a baby "boomlet" during the late 1970s? Clearly, we need a thoroughgoing assessment of the representativeness of the PNAD surveys, as well as a comparison of the advanced tabulations against the definitive 1980 census results. Although both of these tasks run well beyond the scope of this report, they have major implications for the present analysis of trends in the 1970s, which relies heavily on data from the 1976 survey.

Expectation of Life at Birth

Table 3 presents estimates of national and regional trends in the expectation of life at birth. In contrast with total fertility, there is a substantial increase (26 percent) in life expectancy at the national level. There are also important regional differentials, with the Northeast lagging behind the rest of the country by about 10 years of life expectancy; using the ratio of Sao Paulo to the Northeast as an index, the relative difference was about 27 percent. While all regions experienced increased

TABLE 3 Expectation of Life at Birth, 1950-76: Brazil and PNAD Regions

Region	1950	1960	1970	1976
1. Rio de Janeiro	48.7	60.3	60.3	68.5
2. Sao Paulo	49.2	60.3	61.6	67.1
3. Southern States	51.5	61.2	62.8	66.5
4. Minas Gerais/ Espirito Santo	46.9	55.2	58.4	65.0
5. Northeastern States	38.5	41.6	48.3	52.6
6. Brasilia	--	--	58.0	67.4
7. Frontier States	47.8	56.9	59.7	--
Brazil: Total	44.7	52.4	56.3	61.1
Urban	43.8	--	56.6	61.6
Rural	45.1	--	56.0	57.5

Note: -- indicates that data were not available.

Source: National Research Council (1983).

life expectancy during the 1950-70 interval, this pattern of regional differentials remained constant.

The pace of improvement in life expectancy increased during 1970-76. At the national level, it increased by 5 years in a 6-year period, compared to a 12-year increase over the previous 20 years. Percentage increases in Sao Paulo and the Northeast were about equal (9 percent), but Rio de Janeiro increased by nearly 14 percent. The pattern of rural-urban differentials shifted from a slight advantage for rural areas in 1950 to a slight advantage for urban areas in 1970, and a widening spread between urban and rural areas between 1970 and 1976.

Income Class Differences in Fertility and Mortality

Socioeconomic differences in fertility and mortality are another important dimension of recent Brazilian demographic trends, though there are fewer data with which to document them. Working with special tabulations of the 1970 census, Carvalho and Paiva (1976) reported a differential of over 4 children per woman in comparing total fertility rates for high- and low-income families. Their results are summarized in the top half of Table 4. For Brazil, total fertility in the 1-150 Cruziero per month

TABLE 4 Income Class Differences in Total Fertility Rates and the Expectation of Life at Birth, 1970: Brazil and Selected States

Region	Average Monthly Household Income (cruzeiros)			
	1-150	151-300	301-500	500+
Total Fertility Rates				
Central Northeast[a]	8.55	8.15	6.28	3.95
Minas Gerais/Espirito Santo	8.03	8.50	7.27	4.62
Rio de Janeiro	6.23	5.43	4.40	2.71
Sao Paulo	5.93	5.35	4.50	2.93
Santa Catarina/Rio Grande do Sul	6.08	5.79	4.97	3.25
Brazil	7.54	6.72	5.37	3.28
Urban	7.03	5.95	4.84	3.10
Rural	7.81	7.99	7.70	5.86
Expectation of Life at Birth				
Central Northeast[a]	43.8	46.1	50.3	54.4
Minas Gerais/Espirito Santo	53.8	55.4	58.6	62.3
Rio de Janeiro	54.1	54.8	57.6	62.1
Sao Paulo	54.7	56.1	58.7	63.9
Santa Catarina/Rio Grande do Sul	60.5	61.2	63.4	66.9
Brazil	49.9	54.5	57.6	62.0
Urban	46.0	53.7	57.6	62.2
Rural	51.4	55.9	57.6	60.0

[a]Ceara, Rio Grande do Norte, Parnaiba, Pernambuco (including Fernando de Noronha), and Alagoas.

Sources: Total fertility rates from Carvalho and Paiva (1976); expectation of life at birth from Carvalho and Wood (1978).

group was 7.54, compared to 3.28 for women in the 501 Cruziero and over group. Their data also reveal rural-urban and regional differentials within income classes: rural-urban differences increase with income, from less than one child to nearly three children; in contrast, regional differences narrow (using the Central Northeast and Sao Paulo as illustrative cases) from 2.6 to 1.1 children.

Equally dramatic mortality differentials were found. Using the same tabulations, Carvalho and Wood (1978) noted a striking 20-year differential between the life expectancy of low-income families in the Central Northeast and that of high-income families in Sao Paulo, and an even greater difference when the Northeast was compared to the Southern states of Santa Catarina and Rio Grande do Sul. Their results, summarized in the bottom half of Table 4, also suggest that for low-income households, life expectancy was higher in rural than in urban areas. However, caution is required in interpreting this difference since the income figures do not include income in kind, which was higher in rural areas; thus the true level of living among these groups may have been understated. In contrast to the fertility differentials, regional differentials in mortality were maintained at about 10 years as income increased, while rural-urban differences narrowed. Both sets of differentials highlight the importance of underlying socioeconomic variables in the regional differentials observed during the 1950-70 period; attention to changes in these variables will therefore be important in explaining the acceleration in Brazil's fertility decline after 1970.

PURPOSE AND STRUCTURE OF THIS REPORT

What changes could account for the accelerated fertility decline in Brazil since 1970? The evidence presented thus far suggests that a major factor was the spread of fertility decline after 1970 to new regions and socioeconomic groups, together with continued decline among those already affected. The objective of the present report is to examine this acceleration in greater detail. The discussion therefore focuses on some specific questions about what may have happened in the post-1970 period; it is not intended to be an exhaustive study of longer-term trends and differentials.

As noted above, the main sources of national-level data used here are the public use sample of the 1970 census of population and the 1976 PNAD national household survey. Both of these sources provide information on such socioeconomic characteristics as marital status, migration, rural-urban residence, income, and education; they also provide the data on births and surviving children needed to make indirect estimates of fertility and mortality. They do not include questions on contra-

ception and other proximate variables, nor are other national-level survey data on these variables available. State-level data are found in reports of the Contraceptive Prevalence Surveys (CPS) conducted by Brazil's International Planned Parenthood Federation (IPPF) affiliate, Sociedade Civil Bem-Estar Familiar no Brasil (BEMFAM), with the cooperation of the U.S. Center for Disease Control; six such surveys were available when the report was prepared (Sao Paulo, Piaui, Rio Grande do Norte, Pernambuco, Paraiba, and Bahia). Local case study data on the proximate variables were assembled for the Centro Brasileiro de Analise e Planejament (CEBRAP) National Investigation on Human Reproduction (NIHR), which is examined in detail in Part II.

This study is organized as follows. Following the summary, Part I concentrates primarily on national-level data. Chapter 1 uses national census and survey data on fertility and nuptiality, together with CPS state-level data on contraception, abortion, and breastfeeding, to decompose recent fertility declines into the proximate determinants of fertility; this analysis is based on the standardization approach to decomposition of changes at the national level. In Chapter 2, national data are used to identify the level and amount of change in socioeconomic fertility differentials from 1970 to 1976. Chapter 3 examines hypotheses about links between changes in the proximate determinants and socioeconomic conditions in Brazil during the early 1970s, as well as national-level empirical evidence relating to these hypotheses. Chapter 4 uses multivariate regression analysis to clarify links between changing socioeconomic conditions and changes in average parity, with reference to the analytical questions raised in the previous chapter.

Although Part I makes some reference to relevant local-level NIHR findings, its primary focus, as noted above, is at the national level. Part II of this report focuses specifically on the NIHR to provide a more concentrated analysis of Brazilian fertility. Chapter 5 describes the purpose and methodology of the NIHR. Chapter 6 summarizes fertility levels and trends for the contexts studied, which are described in detail in the Appendix. Chapter 7 presents a discussion of local trends in nuptiality, including variations in union type and age at marriage. Chapter 8 examines data related to declining marital fertility, while Chapters 9 and 10 analyze the role of the proximate determinants and socioeconomic variables, specifically family income,

respectively, in that decline. Finally, Chapter 11 presents some conclusions about Brazil's accelerated fertility decline based on the NIHR data. It is hoped that together, the broader and more focused perspectives offered in this report will provide a balanced understanding of Brazil's recent fertility trends.

PART I FERTILITY DETERMINANTS AT THE NATIONAL LEVEL

CHAPTER 1

THE PROXIMATE DETERMINANTS OF FERTILITY

The objective of this chapter is to analyze Brazil's accelerated fertility decline in demographic terms. Demographic theory indicates that two sets of variables are important: one is population composition, particularly age structure and marriage patterns, both of which mediate the relation between individual reproductive behavior and birth rates observed in a population; the other is comprised of the Davis-Blake (1956) "intermediate variables," such as frequency of intercourse, fertility control, breastfeeding, and abortion, which directly affect reproductive outcome. This chapter uses a standardization approach to identify compositional effects, and Bongaarts' (1980) method for decomposing natural fertility into its proximate determinants to identify intermediate variables.

This chapter is based on the available data for Brazil, which are fragmentary in both regional and time coverage. The approach is therefore essential detective work, piecing together clues from a variety of sources in an attempt to draw a picture at the national level. Changes in marriage patterns and age structure are always prime suspects in declining birth rates; therefore, the discussion begins by assessing changes in the distribution of women by marital status and in mean age at marriage, and then applies standardization techniques to check whether these changes and those in age structure played a major role in Brazil's fertility decline. The available evidence suggests that they did not. This suggests in turn that the primary factor in the decline was one of the intermediate variables affecting marital fertility. The Bongaarts framework is then used to explore this possibility. There are three potential factors responsible--breastfeeding, contraception, and abortion. Among these, the limited

degree to which the first is practiced in Brazil is sufficient to eliminate it as a primary influence. The evidence implicating the second is stronger, though admittedly fragmentary. Finally, although the evidence is clearly circumstantial, it is strong enough to implicate abortion as an important, though necessarily indeterminate, influence on Brazil's fertility decline.

MARITAL STATUS AND MEAN AGE AT MARRIAGE

As noted above, the reporting of marital status in Brazilian data is problematic. The reported percentage distribution of Brazilian women aged 15-49 by marital status in the 1950, 1960, and 1970 censuses and in the 1976 PNAD survey are presented in Table 5; preliminary results of the 1980 census are also reported. Four marital status categories are shown--married, divorced and separated, widowed, and single. Each of these categories presents its own set of problems.

First, in the married category, there is a problem in the reporting of women in consensual unions. According to Henriques (1980), women in consensual unions account for an important share of Brazilian births, though Brazil has a lower proportion of such births than a number of other Latin American countries. However, although Brazilian data include women in consensual unions as a subcategory of married women, there is strong evidence that a number of those who report themselves as single may in fact be in consensual unions (Silva, 1979:14). This is suggested by data in Table 6, which shows the percent of women in the single category who reported having had a birth from age 15-19 to 40-49 in the censuses and PNAD survey.

Brazilian census authorities have attempted to improve on the reporting of consensual unions by broadening the number of categories of marital status to include the type of union. In 1950, when there was no subcategory for consensual unions, nearly four out of ten single women reported a birth by the end of their reproductive years, suggesting that most of these unions were grouped in the single category (Altmann and Wong, 1981a:356). This contrasts with 1960, when the consensual union category was introduced and the proportion of single women reporting a birth dropped to 11 percent. It should be recalled that tabulation of the 1960 census was delayed until the late 1970s because of administrative

TABLE 5 Reported Percent Distribution of Women by Marital Status and Age, 1950-80: Brazil

Age	Married[a]	Divorced, Separated	Widowed	Single	Total[b]
1950					
15-19	14.8	0.0	0.1	85.1	100.0
20-24	51.9	0.0	0.7	47.4	100.0
25-29	70.4	0.1	1.8	27.7	100.0
30-39	76.3	0.2	5.1	18.4	100.0
40-49	71.2	0.3	14.1	14.4	100.0
1960					
15-19	14.0 (1.3)	0.7	0.1	85.2	100.0
20-24	53.3 (3.6)	2.6	0.4	43.7	100.0
25-29	74.0 (5.1)	3.4	1.1	21.5	100.0
30-39	80.9 (5.4)	3.9	3.1	12.1	100.0
40-49	76.2 (4.9)	4.8	10.1	8.9	100.0
1970					
15-19	12.0 (1.4)	0.5	0.1	87.4	100.0
20-24	46.9 (3.9)	2.0	0.3	50.8	100.0
25-29	71.3 (5.4)	3.0	0.9	24.8	100.0
30-39	80.2 (5.7)	4.1	2.8	12.9	100.0
40-49	76.2 (4.9)	5.6	8.9	9.3	100.0
1976					
15-19	11.2 (1.9)	0.6	0.1	88.1	100.0
20-24	46.2 (5.4)	2.0	0.2	51.6	100.0
25-29	69.8 (6.8)	3.0	0.8	26.4	100.0
30-39	79.5 (7.4)	4.9	2.6	13.0	100.0
40-49	77.7 (6.6)	5.9	8.4	8.0	100.0
1980					
15-19	16.3 (3.5)	0.5	0.0	83.2	100.0
20-24	53.2 (8.0)	2.0	0.3	44.5	100.0
25-29	72.6 (9.1)	3.2	0.7	23.5	100.0
30-39	79.9 (9.3)	4.5	2.3	13.3	100.0
40-49	77.0 (7.7)	6.3	7.7	9.0	100.0

[a]Figures in parentheses represents women in consensual unions as a percent of all women, when reported.
[b]The total excludes women who did not report marital status.

Sources: 1950-80 from population censuses; 1976 from PNAD survey.

breakdowns, and that procedures used in reconstructing it may have biased the results. The reported trend from 1960 to 1976 is puzzling, since it suggests that births to single women increased. It is possible that PNAD interviewers, who were more highly trained than census interviewers, were more careful in identifying single mothers.

TABLE 6 Percent of Single Women Who Report Having Had a Child, by Age, 1950-76: Brazil

Age Group	1950	1960	1970	1976
15-19	1.7	0.4	0.7	1.5
20-24	10.0	2.4	3.8	6.0
25-29	22.3	5.5	8.7	10.2
30-39	34.3	8.8	14.6	17.9
40-49	38.7	10.9	16.3	23.5

Source: Published tabulations of census and survey data.

The impact of misreporting of women in consensual unions appears to be greatest among younger women. For women aged 20-24, the proportion reported as married increases from 51.9 percent in 1950, when consensual unions were not included as a subcategory, to 53.3 percent in 1960, when the subcategory was introduced. To illustrate the possible influence of consensual unions on reporting, the percentage of women in the consensual union subcategory is indicated in parentheses in Table 5 next to the percent married after 1960 (the basis of this percentage is all women in the age category). The proportion of women aged 20-24 reported as married decreases from 1960 to 1976, then increases sharply to 53.2 percent (about equal to 1960) in the 1980 results. At the same time, the percent of women in consensual unions increases, particularly in 1980, when the figure is 8 percent of all women (15 percent of married women). Published tabulations of the preliminary 1980 results do not supply enough information to determine whether, in editing, single women with births may have been reclassified as being in consensual unions. The evidence suggests either that consensual unions have been increasing or that reporting of such unions has improved. In all likelihood, results for earlier periods understate the proportion of younger women reported as married. Such underreporting would bias the age-specific marital fertility rate for these women upward if that proportion were used in the calculation of the rate; it would also add a further bias to the extent that consensual unions were recognized when a woman gave birth to a child.

Although the impact of the underreporting of consensual unions is reduced by grouping all single women with births in the married category, it is not eliminated. One is still left with the problem of women in informal unions who have no children, but should be included in the denominator when fertility rates are calculated. This omission could bias calculation of rates for younger women, particularly when the beginning of an informal union is not clearly demarcated and the birth of a child leads to recognition (or admission) of the union. Including in the married category only those "single" women who had births will lead to overstatement of marital fertility rates. One way to compensate for this is to assume that the proportion of single women "at risk" is equal to that of married women; that is, if 50 percent of married women aged 20-24 report a birth, then assume that the single women aged 20-24 reporting a birth represent 50 percent of the single women at risk. This at-risk group can then be added to the married category. This procedure will be employed later in calculating the denominators for marital fertility rates. The issue of type of union and its relationship to fertility at the local level is explored in detail in Part II of this report.

A second problem of consistency in the Brazilian data on marital status relates to the reporting of separated and divorced women. Because Brazil legalized divorce only in 1977, its effects cannot be observed directly even in the 1976 survey. However, reporting of foreign divorces, legal separations, and a special Brazilian legal substitute for pre-1977 divorces (desquites) was increasing in the years prior to actual legalization. The contrast is sharpest between 1950, when practically no divorces and separations were reported, and the other data points. Because divorce was not legally recognized, it was fairly common practice for women who had entered a second union after separation to be declared as separated rather than married, leading to further underreporting of the proportion of women in unions.

Such problems with the reliability of marital status data suggest that considerable caution is required in the calculation and interpretation of measures incorporating those data. This applies not only to the proportion of women in unions, but also to measures of the average age at marriage and marital fertility rates. Table 7 summarizes the results of calculations of the singulate mean age at marriage (SMAM), which is based on the proportion

TABLE 7 Singulate Mean Age at Marriage (SMAM), by Region, 1950-76: Brazil

PNAD Region	1960	1970	1976
1. Rio de Janeiro	22.92	23.77	23.93
2. Sao Paulo	22.25	23.30	23.47
3. Southern States	21.66	22.17	22.80
4. Minas/Espirito Santo	22.36	23.36	23.66
5. Northeast States	22.18	22.90	23.13
6. Brasilia	20.45	23.38	23.73
7. Frontier States	21.21	22.04	--
Brazil			
Marriage	22.11	22.91	23.33[a]
First Birth	22.42	23.28	23.84[a]

[a]The Brazil figure for 1976 excludes rural areas of Region 7, which was not included in the PNAD survey.

Source: SMAMs calculated from census and survey distributions of women by marital status considering single women who reported having had children as married. First-birth measure based on same computation as SMAM, but substituting the proportion of women reported as childless.

of women reported as single at different ages. In order to reduce the impact of underreporting of consensual unions, single women reporting a birth were considered married. SMAMs were calculated for the PNAD regions and Brazil as a whole in 1960, 1970, and 1976. For Brazil as a whole, the data indicate a comparatively late average age at marriage and suggest that this average increased by more than one year between 1960 and 1976. Most of this increase came between 1960 and 1970, and resulted from a more than 6 percentage point rise in the proportion reported as single between the two dates. It was not possible to include single women with births in the calculation of the SMAM for 1980; nevertheless, with the

decreased proportion reported as single in the preliminary results, the average age at marriage dropped back to the 1960 level of 22.1 years. It should also be noted that the preliminary 1980 results are not fully comparable to those for earlier dates since it was necessary to use 10-year age groups for women over age 30.

The breakdown of SMAMs by region indicates a fairly homogeneous pattern, with lower average ages in the Southern and Frontier states, and higher average ages in the Southeastern states (Regions 1, 2, and 4). The largest increase in average age at marriage is found in Region 6 (Brasilia); it may be observed that the composition of Brasilia's population changed significantly from the 1960s, when it was being constructed, to the 1970s, when it began to function fully as the national capital. For the remaining regions, increases range from .5 to 1.0 years in 1960-70 and .2 to .6 years in 1970-76.

Since there are questions about the reliability of the marital status data on which the SMAMs are based, another way of looking at the age at which exposure to the risk of childbearing starts is to consider the mean age at first birth. This can be derived from data on the proportion of women who remained childless at different ages using the same computational procedure employed in calculating SMAMs. The resulting index, calculated only for national-level data, is shown in the second row of results for Brazil in Table 7. For 1960 and 1970, the average age at first birth is .3 years higher than the age at marriage. This increases to .5 years in 1976. The 1980 average, not shown in the table, is 22.1 years, just equal to the average age at marriage.

MARITAL FERTILITY

How much did changes in the proportions married and age at marriage contribute to the acceleration of Brazil's fertility decline? Table 8 attempts to link total and age-specific fertility rates (ASFRs) to total marital fertility and age-specific marital fertility rates (ASMFRs) using the 1960, 1970, 1976, and 1980 data. The first column of the table shows ASFRs and total fertility rates calculated for the Brazil report of the Committee on Population and Demography, National Academy of Sciences. The total fertility rates are the same as those reported in Table 2, showing declines of about 6 percent from 1960 to 1970, 24 percent from 1970 to 1976,

TABLE 8 Age-Specific And Total Marital Fertility Rate Calculations, 1960, 1970, 1976, and 1980: Brazil

Age Group	ASFR[a]	Percent Married[b] (a)	(b)	ASMFR[c]	ASMFR[d]
1960					
15-19	.0799	14.0	15.3	.354[e]	
20-24	.2719	53.3	57.6	.472	
25-29	.3150	74.0	79.8	.395	
30-34	.2615	80.3	87.5	.299	
35-39	.1935	81.4	90.8	.213	
40-44	.0908	77.9	91.7	.099	
45-49	.0239	74.3	92.7	.026	
Total	6.18	58.9	65.7	9.29	
1970					
15-19	.0753	12.0	13.7	.373[e]	.352[e]
20-24	.2564	46.9	51.6	.497	.469
25-29	.2971	71.3	77.6	.383	.384
30-34	.2466	80.2	87.3	.282	.287
35-39	.1825	81.1	91.0	.200	.209
40-44	.0856	77.8	92.0	.093	.102
45-49	.0225	74.3	92.8	.024	.033
Total	5.83	55.5	62.8	9.27	9.18
1976					
15-19	.0733	11.3	14.1	.295[e]	.284[e]
20-24	.2062	46.3	52.3	.394	.379
25-29	.2240	69.8	76.5	.293	.292
30-34	.1874	78.8	87.4	.214	.222
35-39	.1292	80.3	91.6	.141	.147
40-44	.0588	79.4	93.7	.063	.071
45-49	.0108	75.7	94.2	.011	.015
Total	4.45	55.2	63.3	7.06	7.05
1980					
15-19	.0850	.163	.168	.278	
20-24	.2054	.532	.555	.370	
25-29	.2071	.726	.765	.271	
30-34	.1604	.799	.867	.185	
35-39	.1030	.799	.867	.119	
40-44	.0488	.770	.910	.054	
45-49	.0093	.770	.910	.010	
Total	4.10	58.5	64.8	6.44	

Sources:

[a]ASFR: Age-specific fertility rate: Panel on Brazil, Committee on Population and Demography, National Academy of Sciences.
[b]Percent married: in column (a) as reported in published tabulations; in column (b) adjusted to include all ever-married women; and, except for 1980 when data not available, single women "at risk" as explained in text.
[c]ASMFR: Age-specific marital fertility rate: computed using ASFR and percent married, variant (b).
[d]ASMFR: Age-specific marital fertility rate: computed from special tabulation of births in previous year for ever-married women, and and adjusted by P/F ratios for all women (1.32 in 1970 and 1.22 in 1976). Not available for 1960 and 1980.
[e]ASMFR for 15-19 computed as .75 ASMFR for women aged 20-24.

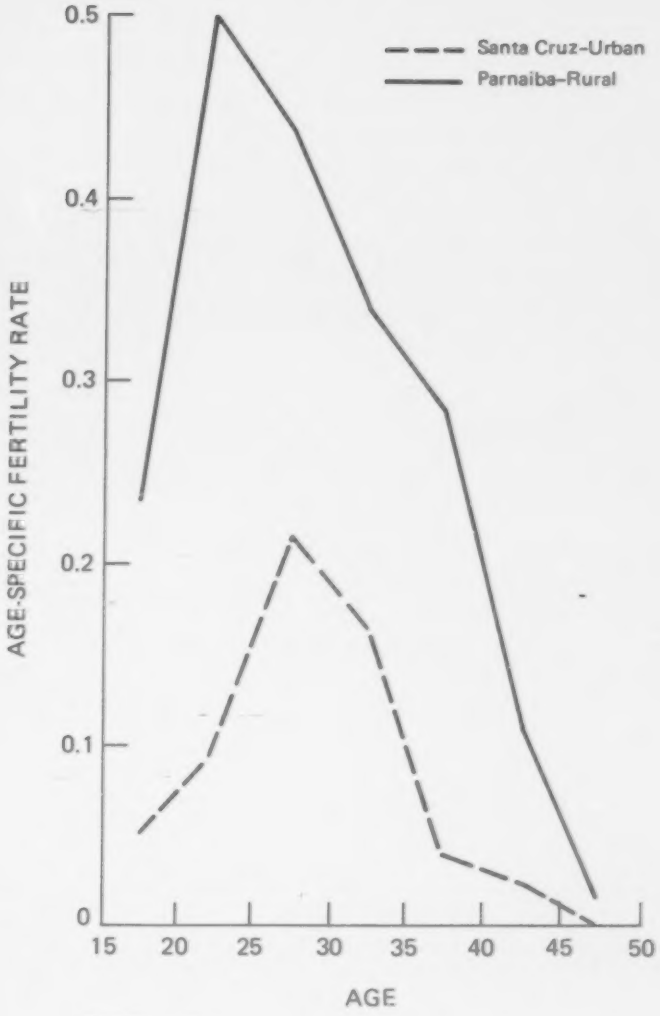

FIGURE 5 Age-Specific Fertility Rates, 1975: Brazil

and about 8 percent from 1976 to 1980. As can be seen in Figure 5, the shape of the age-specific fertility rate profile became somewhat flatter with the decline, which was substantial for all age groups except the youngest. The largest absolute decline occurred at ages 25-29, with larger proportional declines among the older age categories.

A first attempt was made to translate ASFRs into age-specific marital fertility rates by using data on

marital status from published reports, as shown in column (a) under "percent married" in Table 8. Because of the underreporting of women in consensual unions, ASMFRs appear to be biased upward, particularly for women in their twenties. In 1970, for example, the ASMFR for the 20-24 group would be .547; this would mean that the fertility of Brazilian women exceeded that of the Hutterites, one of the populations on whose experience standard natural fertility schedules are based. To reduce this bias, the proportion "married" was adjusted to include all ever-married women, single women who reported a birth, and a prorated number of single women "at risk" based on the proportion of married women reporting a birth, as shown in column (b) under "percent married" in the table. This adjustment raised the percent married by about 7 percentage points for each observation; although this did not reduce the decline of about 5 percentage points in the proportion married among women 20-24 between 1960 and 1970, it did narrow the differences between 1970, 1976, and 1980. The increase in the proportion married among women in older age categories arises from the addition of widowed, separated, and divorced women.

Even with these adjustments, the ASMFRs and total marital fertility rates for 1960 and 1970 are quite high--nearly 9.3 for both dates. By 1976, total marital fertility falls to 7.06, a decline of 24 percent, with a further decline of 9 percent to 6.44 in 1980. While total marital fertility shows little change between 1960 and 1970, the rate for women aged 20-24 increases. This occurs because the decline in the ASFR for that group is less than the decline in the proportion married, even after adjustment. The rate for women aged 15-19 is similarly affected since it was calculated as .75 of the rate of those aged 20-24. Because these rates are so high, total marital fertility is very sensitive to such differences, which are as likely to be the result of differences in reporting (or editing, as suggested above) as they are to be real. Thus considerable caution is required in interpreting the 1960-70 period.

Access to public use sample files for the 1970 and 1976 data made it possible to tabulate the observed number of births by marital status in the year prior to interviews; this provided a check on the rates calculated from ASFRs. Observed births were adjusted by the P/F ratios used in adjusting ASFRs for that date. The resulting ASMFRs and total marital fertility rates are shown in the last column of Table 8. These rates are not

exactly comparable to those calculated directly from ASFRs since the adjustment of observed births used in deriving ASFRs also included a factor to account for the one-half-year difference between women's reported age and their age when births actually occurred. Because it is inappropriate to apply this factor when the denominator is limited to ever-married women, the age profiles of ASMFRs differ with the two approaches. The main difference is that rates based on the tabulations are lower for women under 25 and higher for women over 30. Total marital fertility is slightly lower in 1970 and virtually the same in 1976 in the tabulated results. Comparison of the two sets of rates suggests that the decline in marital fertility probably was close to 24 percent over the 1970-76 period; however, there is a need to be cautious about both the level and age profile of marital fertility rates.

The age category most seriously affected is 20-24. Two factors could account for an overstatement of the age-specific marital fertility rate for this group. One is the underreporting of married women discussed above. The other is that the adjustment factors derived using the Brass technique may be too high for this group. Estimates of ASMFRs using model marital fertility schedules suggest that this may in fact be the case (see Berquo and Leite, 1979; Altmann and Wong, 1981a; Leite, 1981). One way to visualize the extent of possible bias is to compare observed ASMFRs to model schedules, as shown in Figure 6. Both of the 1970 ASMFR schedules from Table 8 are plotted against these model schedules. The models are based on a total marital fertility rate of 9.25, with the Coale-Trussel index of fertility control set at three levels: 0.0, the natural fertility level, and 0.3 and 0.5, indicating moderate fertility control. The model schedule with the index set at 0.5 provides a very close approximation to both of the observed 1970 ASMFR schedules for ages 25-29 to 40-44. The observed rates for age 20-24 exceed the model schedule, though the second schedule (estimated from births reported for "married" women, broadly defined) is closer than the rate calculated from dividing ASFRs by the proportion married. The comparison suggests that the 1970 base for calculating declines between 1970 and 1976 among the younger age groups may be too high, resulting in an exaggeration of declines for women in these age categories.

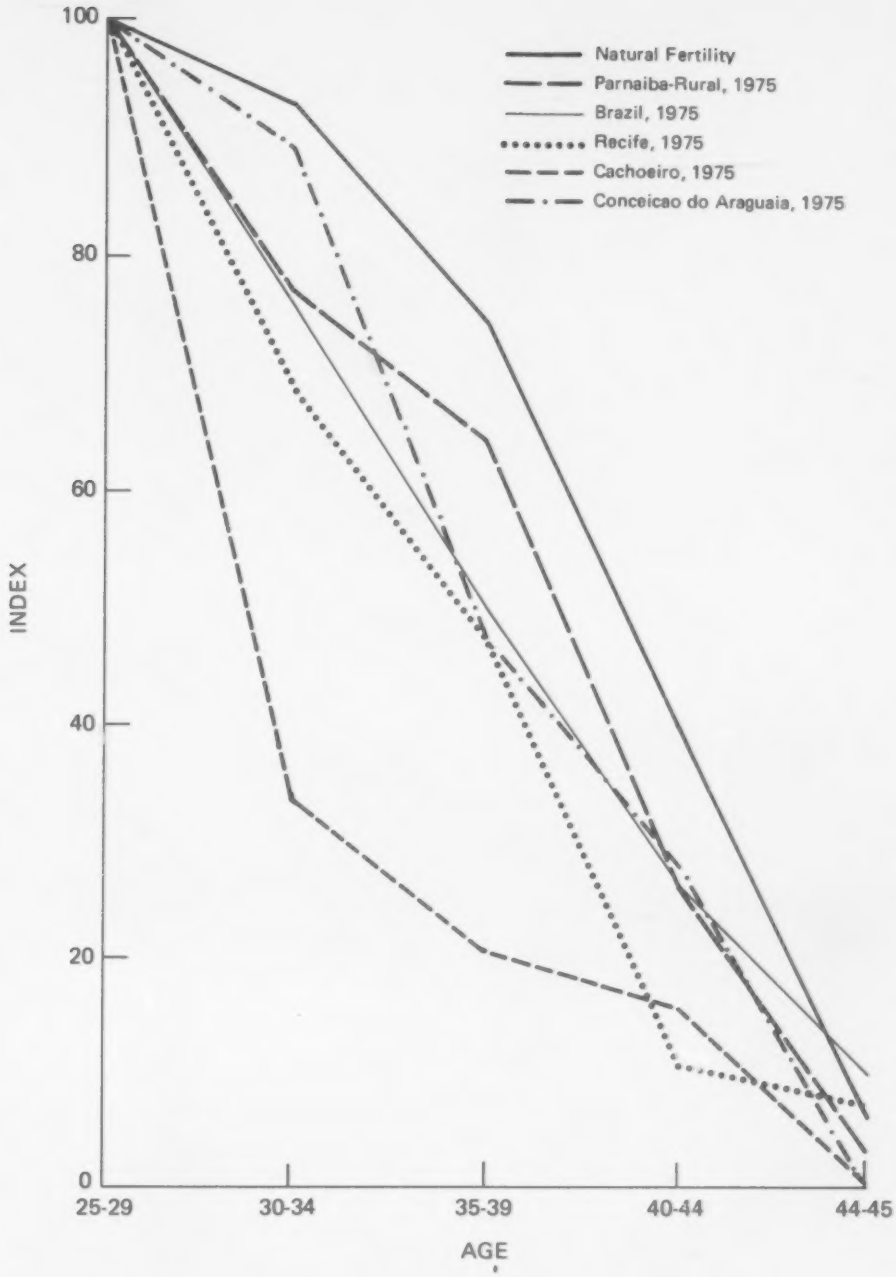

FIGURE 6 Age-Specific Marital Fertility Rates ($ASMFR_{25-29}$ = 100), Six Contexts: Brazil

DECOMPOSITION OF CHANGE IN BIRTH RATES

Standardization techniques to decompose the contributions of changes in marriage patterns and age structure and in marital fertility to declines in the general fertility rate (GFR) and crude birth rate (CBR) are described in United Nations Manual IX, The Methodology of Measuring the Impact of Family Planning Programs on Fertility (United Nations, 1979). The standardization method takes account of the contribution of shifts in age structure within the reproductive ages, as well as changes (for the CBR) in the proportion of women of reproductive age among the total population. All the measures required for these techniques are found in the Brazilian data for 1960, 1970, and 1976. However, considerable caution is required in interpreting results because of the poor reporting of marital status and possible overstatement of marital fertility rates discussed above.

For the GFR, the decomposition is as shown in Table 9. For the 1960-70 interval, there is a decline of 15 per 1,000 in the GFR. Of the three factors contributing to that decline, shifts in the marital status distribution account for the largest share (8 per 1,000). This reflects the reported decline in the percent married from 66 to 63 percent shown in Table 8; it should be viewed as skeptically as other measures depending on the marital status reporting of the 1960 census data. Marital fertility accounts for the smallest part of the decline in the GFR (2 per 1,000), while shifts in age structure within the reproductive ages make up the remaining 5 per

TABLE 9 Decomposition of Change in General Fertility Rate, 1960-76: Brazil

Component	1960-70	1970-76
GFR, base year	189.18	174.18
GFR, end year	174.18	136.42
Observed change (per 1,000)	-14.99	-37.76
Reproductive age structure	-4.89	0.78
Marital status distribution	-8.10	0.88
Marital fertility	-2.06	-40.49
Interaction	0.06	1.07

1,000. The composition of the much larger 1970-76 decline in the GFR (nearly 38 per 1,000) contrasts sharply with that of 1960-70. Marital fertility accounts for the entire decline; in fact, the decline would have been greater had not the marital status and age structure factors been slightly offsetting.

The standardization approach can also be used to decompose declines in the CBR with the addition of a factor to account for shifts in the proportion of women of reproductive age among the total population. For the two periods being studied, the breakdown is as shown in Table 10. The proportional contributions of the three components of the GFR to changes in the CBR remain the same, with marital status accounting for most of the change in 1960-70 and declining marital fertility being the only reason for the 1970-76 decline. The interesting addition in 1970-76 is the offsetting effect of the proportion of women of reproductive age among the total population. The larger cohorts born during the years of Brazil's peak birth rates entered the reproductive ages after 1970; their impact dampened the effect of the decline in marital fertility on the birth rate by about a fourth--2.3 out of 9.7 per 1,000.

ROLE OF PROXIMATE VARIABLES

Further insight into the nature of recent fertility trends in Brazil can be gained by examining the role of

TABLE 10 Decomposition of Change in Crude Birth Rate, 1960-76: Brazil

Component	1960-70	1970-76
CBR, base year	45.3	41.6
CBR, end year	41.6	34.4
Observed change (per 1,000)	-3.7	-7.2
Reproductive age women (total)	-0.12	2.28
Reproductive age structure	-1.17	0.19
Marital status distribution	-1.93	0.21
Marital fertility	-0.49	-9.72
Interaction	+0.01	+0.30

the proximate variables identified in the Davis-Blake (1956) framework, and more recently in Bongaarts' (1980) method for decomposing the difference between natural fertility and observed total fertility rates into four proximate determinants. Bongaarts' technique involves the computation of four indices: (1) C_m = the index of the proportion married, which equals one if all women of reproductive age are married, zero if none are; (2) C_c = the index of noncontraception, which equals one in the absence of contraception and zero if all women use 100 percent effective contraception; (3) C_a = the index of abortion, which equals one in the absence of induced abortion and zero if all pregnancies are aborted; and (4) C_i = the index of postpartum infecundability, which equals one in the absence of lactation and postpartum abstinence and zero if the duration of infecundability is infinite. Observed total fertility is linked to natural fertility (the number of births a women would have during her reproductive lifetime if none of the inhibiting factors were operative) by multiplying the number of births that would occur in a natural-fertility regime by each of the indices in succession: $TFR = 15.3 \times C_m \times C_a \times C_c \times C_i$, where 15.3 represents an estimate of the total fecundity rate. It should be noted that the use of a single value to estimate the fecundability level of a population, set at 15.3 children per woman, has been questioned in light of the heterogeneity of populations in relation to a number of factors, such as state of health, duration of cohabitation, and so on. Thus, other values have been proposed for use in estimating this parameter for specific population subgroups (see Lesthaeghe et al., 1981 and Gaisie, 1981). In this report, however, 15.3 will be used.

Data requirements for calculating the four indices are geared to national-level fertility surveys, such as the World Fertility Survey, which include questions on breast-feeding and abortion as well as current contraceptive use. Census and survey data do provide enough information for calculation of the marriage index, which is the ratio of the total fertility rate to the total marital fertility rate, and which remained constant at a level of .63 from 1970 to 1976. In the absence of any nationally representative Brazilian data on the three remaining variables, the best that can be done is to piece together a national "guesstimate" from the fragments of subnational survey data that are available.

The two main sources of survey data for the 1970s are the local-level CEBRAP National Investigation on Human Reproduction (NIHR) and the state-level Contraceptive Prevalence Surveys (CPS), mentioned in Chapter 1. The NIHR interviews were conducted during 1975 in the states of Sao Paulo, Espirito Santo, Rio Grande do Sul, Pernambuco, Piaui, and Para (Berquo, 1976). The first CPS was conducted in Sao Paulo in 1978, followed by Piaui in 1979, and Pernambuco, Rio Grande do Norte, Paraiba, and Bahia in 1980 (Rodrigues et al., 1981a). Additional survey work was being conducted in Southern Brazil in 1981. Prior to these inquiries, the data were limited to a handful of surveys in specific localities: Rio de Janeiro was included in the comparative study of fertility and family planning in nine Latin American cities conducted by CELADE in 1963 (CELADE, 1972), and CEBRAP interviewed women in the municipality of Sao Paulo in 1965 (Berquo et al., 1977a); two other surveys include Martine's 1969 interviews of poor women who were using the services of a maternity clinic in Rio de Janeiro (Martine, 1975) and Etges' survey of women in Porto Alegre and two other localities in Rio Grande do Sul in 1973 (Etges, 1975). The subsections that follow assemble information on current contraceptive use, abortion, and breastfeeding from these surveys in a form that will permit calculation of the Bongaarts' indices.

Contraceptive Use

The index of noncontraception requires information on the percent of fecund married women of reproductive age currently using contraception, as well as a breakdown of methods by type to measure contraceptive effectiveness (Bongaarts, 1980). The available national-level Brazilian data are summarized in Table 11; as noted in Chapter 9, these data are paralleled by local-level NIHR data. The 1965 Sao Paulo survey is reported (Nakamura et al., 1979) to indicate that 66 percent of eligible women were using contraception, a higher proportion than was reported for Rio de Janeiro (38 percent) a year earlier. However, it is not apparent from reports on the Sao Paulo survey (Berquo et al., 1977a) whether the figure refers to current or ever use; if it is the latter, then 66 percent probably overstates current use. Both surveys indicate that methods other than the pill and sterilization were predominant. Martine's 1969 data on poor women in Rio

TABLE 11 Contraceptive Prevalence, Summary of Survey Data: Brazil

Site of Survey	Date	Users: Percent of Women	Method (percent)			Index	
			Pill	Steri-lization	Other	E[a]	C_c[b]
Rio de Janeiro	1963	38.1	7.3	16.0	76.7	.763	.680
Rio de Janeiro	1969	31.3	45.0	n.a.	55.0	n.a.	n.a.
Rio Grande do Sul	1973	64.6	56.9	8.5	34.6	.839	.349
Sao Paulo, Sao Paulo	1978	63.4	47.3	21.9	30.8	.860	.345
Sao Paulo, Rest	1978	58.6	46.1	24.0	29.9	.864	.392
Piaui, Teresina	1979	44.9	26.1	62.8	11.1	.941	.493
Piaui, Rest	1979	28.8	33.9	46.7	19.4	.908	.686
Pernambuco, Metro Recife	1980	51.5	24.1	56.9	19.0	.919	.432
Pernambuco, Rest	1980	35.0	36.0	35.1	28.9	.877	.631
Rio Grande do Norte-Urban	1980	55.0	37.6	42.9	19.5	.904	.403
Rio Grande do Norte-Rural	1980	35.0	38.9	23.7	37.4	.849	.643
Bahia, Metro Salvador	1980	47.8	38.4	23.8	37.8	.848	.513
Bahia, Rest	1980	27.4	37.4	33.7	28.9	.876	.712
Paraiba	1980	43.2	36.3	33.1	30.6	.872	.548

[a]Index of effectiveness: sterilization = 1; Pills = .9; others = .7.
[b]Index of contraception: 1 - (proportion using x effectiveness index x 1.1 where 1.1 is sterilization factor.

Sources: 1963: CELADE (1972:178); 1969: Martine (1975:125); 1973: Etges (1975:95); 1978-80: Rodrigues et al. (1981b:Table 5); Paraiba 1980: Rodrigues et al. (1981a:Table 3).

indicate a sharp rise in pill use in the late 1960s; however, his survey is not comparable with the others since it did not include women who had been sterilized. The data on Rio Grande do Sul also show increased use of the pill, as well as a contraceptive use rate of nearly 65 percent.

The 1978 Sao Paulo CPS indicated that 63 percent of currently married women aged 15-44 were using contraceptives in the city of Sao Paulo, a figure slightly lower than that cited in the survey taken a decade earlier. Even if current use really was 66 percent in 1965, the 1978 survey indicates an important increase in effective contraception because of a shift to more effective methods, with the pill and sterilization accounting for nearly two-thirds of users in 1978 compared to less than one-fifth in 1965. The 1978 survey also indicated that contraceptive use was nearly as high in the rest of Sao Paulo, including rural areas, as it was in the capital city. The second CPS survey, conducted in 1979, shifted from Brazil's most developed to its least developed state, Piaui. Current users accounted for 45 percent of women in the capital city of Teresina and 29 percent in the rest of the state, which is predominantly rural. The most noteworthy feature of the Piaui data is the very major role played by sterilization, which represented 63 percent of all fertility control; the figure for the rest of the state was 47 percent. The 1980 Pernambuco and Rio Grande do Norte surveys tell a similar story: over 50 percent of women in Recife were currently using a method, with sterilization accounting for 57 percent of the total; in urban Rio Grande do Norte, sterilization and the pill were used in equal proportions. Finally, it should be noted that prevalence rates in general were higher in the rural areas of these states than in Piaui and Bahia, a reflection of the impact of community-based family planning programs organized by BEMFAM in cooperation with state governments (Rodrigues et al., 1981a).

The last two columns of figures in Table 11 provide estimates of the index of noncontraception (C_c) for each of the surveys for which the needed information was available. Computations were based on Bongaarts' formula: $C_c = 1 - (S \times E \times U)$, where "S" is a correction factor for sterility, "E" is a measure of average contraceptive effectiveness based on the share of each method in the total, and "U" is the proportion of married women currently using a method. The sterility correction factor was set at 1.1, Bongaarts' recommendation for less

developed areas. Values of U were taken from the column showing the percent of current users. The value of E was determined from the three columns showing percent of total use for pills, sterilization, and other methods, with effectiveness ratings of 1.0, 0.9, and 0.7, respectively. Index values for the late 1970s range from about .35 for Sao Paulo to .70 for Bahia state, exclusive of Salvador.

The information in Table 11 falls far short of what is required to compute values of the index of noncontraception for Brazil during the 1970s. Most of the information relates to the later years of the decade, and only a fraction of the total population is represented. At best, these data are a rough guide to the extent of regional differentials, and serve as a basis for guesses at what the trends may have been. For illustrative purposes, they have been used to calculate national-level estimates of the index for three dates (1970, 1976, and 1980). The first step in making such calculations was to determine values for S, E, and U for the three dates, as shown in Table 12. National-level estimates of these measures were derived as follows. The sterilization index was assumed not to vary by region, and was set at 1.1 in 1970, then raised to 1.125 as the prevalence of sterilization increased. Values of U and E were assigned to each of six subdivisions of the Brazilian population, which was broken down by region (Northeast, South and Southeast, and North and Central-West) and by rural-urban residence. Those assignments were based on speculation about levels of these measures that would be consistent with the fragmentary trends suggested by the survey data.

For 1970, effectiveness was assumed to vary from .75 in the rural North and Northeastern regions to .85 in the urban Southeast. It was assumed that E converged on .90 for urban areas and on .85 for rural areas in 1980 as contraceptive use spread. The user rate was assumed to range from .05 for the rural North and Northeast to .55 in the urban Southeast in 1970, and was increased to .35 and .60 for the 1980 assumptions. It should be stressed again that these are merely illustrative figures; they are based on speculation about possible regional patterns of contraceptive use and effectiveness derived from the fragmentary evidence presented in Table 11. Actual numbers on which to base such an assessment simply do not exist. These illustrative figures will be incorporated below in the calculation of overall national-level estimates of the proximate determinants of fertility once similar speculative estimates of the prevalence of abortion and breastfeeding have been described.

TABLE 12 Components of Index of Contraception (C_C), 1970, 1976, and 1980: Brazil

Region	1970 Weight	1970 Users	1970 E	1976 Weight	1976 Users	1976 E	1980 Weight	1980 Users	1980 E
Northeast-Urban	.127	.10	.75	.138	.40	.85	.148	.50	.90
Northeast-Rural	.177	.05	.75	.160	.25	.80	.144	.35	.85
S. East/South-Urban	.389	.55	.85	.425	.60	.90	.460	.60	.90
S. East/South-Rural	.214	.35	.80	.174	.50	.85	.134	.55	.85
North/C. West-Urban	.044	.10	.75	.056	.40	.85	.069	.50	.90
North/C. West-Rural	.049	.05	.75	.047	.25	.80	.045	.35	.85
Brazil	1.00	.32	.80	1.00	.47	.86	1.00	.52	.88

Source: Derived from data presented in Table 11 using assumptions discussed in text.

Abortion

Abortion is illegal in Brazil, and the Brazilian penal code carries a sanction of several years of imprisonment at hard labor for both abortionists and women who practice it (Milanesi, 1970:12-13). However, the code is rarely invoked, except as a legal ploy in such efforts as the attempt to block the importation and use of the IUD as an "abortifacient." Abortion is believed to be widespread; rates of mortality and hospitalization resulting from abortion-related infections are high, though not well documented.

There are no reliable statistical data on abortions at the national level in Brazil, though there are reported estimates (based on some rather implausible extrapolations from the experience of hospitals in a few localities). According to these estimates, the annual number of abortions runs as high as three million per year, which would mean eight abortions for every ten live births (Rodrigues et al., 1975; Carvalho et al., 1981). The hard evidence that does exist suggests that poor, urban, and noncontracepting women are more likely to resort to induced abortion, and that only a fraction of these women identify themselves when the question is asked in survey interviews. Martine (1975) suggests that another reason for low observed abortion rates is the high mortality rate among women having abortions who, as a consequence, would not be accounted for. Questions on abortion have been asked in a number of fertility surveys conducted in Brazil since the early 1960s, including the NIHR and CPS; these provide a basis for calculation of the abortion index.

The way the incidence of abortion is reported varies by survey. For purposes of calculating Bongaarts' index of the effect of abortion on fertility, the ideal would be the total induced abortion rate; this is analogous to the total fertility rate and indicates the number of abortions a woman would have during her reproductive lifetime if current rates prevailed. Either annual age-specific abortion rates or the total number of abortions for women who have completed their reproductive life cycle could be used to calculate such a rate. However, samples are rarely large enough to give reliable estimates by the first method, and in only a few of the Brazilian studies are rates broken down by age. Variability in measures affects both the numerators and denominators of rates. In some cases, numerators refer

to induced abortion, in others to all abortions (spontaneous and induced); some numerators indicate the number of abortions, others the number of women ever having had an abortion. Denominators include the number of women of reproductive age (usually restricted to women in unions) and/or the total number of pregnancies reported by these women.

Table 13 summarizes available statistical information on abortion in Brazil. Hutchinson's data on Rio de Janeiro in 1963 indicate that 9 percent of married women of reproductive age had experienced an abortion, while a 1965 CEBRAP study of Sao Paulo reveals that 18 percent of pregnancies ended in abortions, about one-third of which were induced. Martine's data on poor women in Rio de Janeiro in 1969 suggest a substantially higher incidence of abortion among low-income groups. Etges' study of three municipalities in Rio Grande do Sul in 1973 shows a higher rate of induced abortions as a percent of all pregnancies in Porto Alegre than in two smaller municipalities that he sampled. Questions on abortion have been included in all six of the CPSs for which tabulations are available. Women were asked how many abortions (spontaneous and induced) they had experienced, and whether their last abortion was spontaneous or induced. The proportion of induced abortions in the 1978 Sao Paulo survey was much lower (closer to one-ninth) than the one-third figure of the 1965 Sao Paulo survey; this suggests (1) that induced abortion is underreported in the CPS data, and/or (2) that a higher level of contraceptive use in 1978 may have resulted in a substitution of contraception for abortion (Nakamura et al., 1979:17). The proportion of women reporting having had an induced abortion was higher in urban areas of Sao Paulo. In other CPSs, the proportion of women reporting that they had ever had an abortion was higher in rural areas, but the proportion of pregnancies ending in abortion was higher in urban areas. CPS abortion data have been tabulated by women's age; this permitted a rough approximation of the total abortion rate, which was calculated as the proportion of the difference between the total pregnancy rate and the total fertility rate that could be attributed to induced abortion. This difference averaged .57 per woman in the Northeast, where the total fertility rate was 6.3 per woman. If the reported 10-15 percent share of induced abortion were accepted, the total abortion rate would be a very low .06 to .08 per woman; if all reported terminations of pregnancy were attributed to induced abortion,

then the total induced abortion rate would be .57 per woman.

Berquo (1980) has calculated total abortion rates for the nine localities included in the NIHR survey. These range from .068 abortions per woman in Santa Cruz-Urban in the state of Rio Grande do Sul to .735 in Parnaiba-Rural in the state of Piaui. There is no consistent rural-urban pattern, though there is a suggestion that abortion rates are higher in larger cities and in poorer regions. It is also possible to speculate on total abortion rates using CPS data on the proportion of pregnancies ending in abortion. In Salvador, Bahia, for example, assuming that one-third of reported abortions are induced and the total fertility rate is about 4, the total induced abortion rate would be about .2 per woman; for Bahia-Rural, with a total fertility rate of 7, the total abortion rate is about the same. For Recife, calculation based on a total fertility rate of 4 yields an abortion rate of .25 per woman, about half of the rate indicated in the NIHR data; this is again consistent with the interpretation that (1) the CPSs underreport abortion more than does the NIHR survey, and/or (2) increased contraceptive use is being substituted for abortion.

The Bongaarts index for measuring the effect of abortion on the fertility rate is defined by the expression

$$C_a = \frac{TFR}{TFR + 0.4\ (1+u)\ TAR},$$

where "u" is the parameter already estimated when calculating the contraception rate. C_a becomes zero if all pregnancies are aborted, and is equal to 1 if all are successful. In applying this index to recent Brazilian fertility trends, one can at best speculate on orders of magnitude suggested by these survey results for the total induced abortion rate. There are several qualifications to be noted here. First, it is very likely that the survey data presented above greatly understate the abortion rate. Second, in addition to showing the prevalence of abortion, variation in Bongaarts' abortion index also reflects the level of fertility and of contraceptive use (to the extent that both, in turn, are related to the potential number of pregnancies to be aborted). Thus abortion, contraception, and fertility must be balanced in any calculations. Finally, uncertainty about the level of the abortion rate also relates to the impact of

TABLE 13 Reported Abortions, Summary of Survey Data: Brazil

Site of Survey	Date	Rate	Abortion Measure/Base Population	Source
Rio de Janeiro	1963	9.2	Induced Abort./Married Women 20-50	Hutchinson (1964:23)
Sao Paulo	1965	6.2	Induced Abort./Pregnancies	Berquo et al. (1977a:389)
Sao Paulo	1965	18.0	All Abort./Pregnancies	Berquo et al. (1977a:389)
Rio de Janeiro	1969	22.5	Induced Abort./Low Income Women	Martine (1975:38)
Porto Alegre-RGS	1973	13.2	Induced Abort./Pregnancies	Etges (1975:44)
Sao Leopoldo-RGS	1973	4.6	Induced Abort./Pregnancies	Etges (1975:44)
Caxias do Sul-RGS	1973	5.2	Induced Abort./Pregnancies	Etges (1975:44)
Sao Paulo-Capital	1978	14.8	All Abort./Women 15-44	Nakamura et al. (1979:Table 19)
Sao Paulo-Other Urban	1978	14.1	All Abort./Women 15-44	Nakamura et al. (1979:Table 19)
Sao Paulo-Rural	1979	16.8	All Abort./Women 15-44	Nakamura et al. (1979:Table 19)
Piaui-Teresina	1979	13.1	All Abort./Women 15-44	Rodrigues et al. (1981c:65)
Piaui-Rest	1979	19.3	All Abort./Women 15-44	Rodrigues et al. (1981c:65)
Piaui-Teresina	1979	9.4	All Abort./Pregnancies	Rodrigues et al. (1981c:65)
Piaui-Rest	1980	8.4	All Abort./Pregnancies	Rodrigues et al. (1981c:65)
Rio Grande do Norte-Urban	1980	15.2	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Rio Grande do Norte-Rural	1980	18.0	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Rio Grande do Norte-Urban	1980	9.5	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Rio Grande do Norte-Rural	1980	8.4	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)

Pernambuco-Recife	1980	20.2	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Pernambuco-Other Urban	1980	20.1	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Pernambuco-Rural	1980	21.8	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Pernambuco-Recife	1980	16.3	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Pernambuco-Other Urban	1980	13.3	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Pernambuco-Rural	1980	9.3	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Bahia-Salvador	1980	18.2	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Bahia-Other Urban	1980	20.8	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Bahia-Rural	1980	21.8	All Abort./Women 15-44	Rodrigues et al. (1981b:Table 11)
Bahia-Salvador	1980	14.2	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Bahia-Other Urban	1980	10.2	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Bahia-Rural	1980	8.2	All Abort./Pregnancies	Rodrigues et al. (1981b:Table 11)
Cachoeira-Urban (ES)	1975	.179	Total Induced Abortion Rate	Berquo (1981:Table 11)
Santa Cruz-Urban (RGS)	1975	.068	Total Induced Abortion Rate	Berquo (1981:Table 11)
Santa Cruz-Rural (RGS)	1975	.104	Total Induced Abortion Rate	Berquo (1981:Table 11)
Sao Jose-Urban (SP)	1975	.462	Total Induced Abortion Rate	Berquo (1981:Table 11)
Sertaozinho-Rural (SP)	1975	.454	Total Induced Abortion Rate	Berquo (1981:Table 11)
Recife-Urban (PE)	1975	.478	Total Induced Abortion Rate	Berquo (1981:Table 11)
Conceicao Araguaia-Rural (PA)	1975	.263	Total Induced Abortion Rate	Berquo (1981:Table 11)
Parnaiba-Urban (PI)	1975	.617	Total Induced Abortion Rate	Berquo (1981:Table 11)
Parnaiba-Rural (PI)	1975	.735	Total Induced Abortion Rate	Berquo (1981:Table 11)

nonmarriage. It is one thing to assume that most births accrue to women in unions; it is quite another to assume that all pregnancies, particularly those that are aborted, are within unions. In all likelihood, a significant fraction of abortions may be experienced by women who are not in unions. To the extent that these abortions are understated, the estimate of nonmarriage may be overstated.

For illustrative purposes, a range for the total abortion rate of 0.5 to 1.5 per women may be assumed. With an estimated 1976 total fertility rate of 4.4, yielding about 3.75 million births in Brazil, a range estimate of between 500,000 and 1,250,000 annual induced abortions is implied. While these figures fall well below the 3 million annual abortions derived by extrapolation from newspaper and other reports, they seem more plausible than the very low abortion rates yielded by survey data.

Breastfeeding/Postpartum Amenorrhea

Statistical data on breastfeeding and postpartum amenorrhea in Brazil are also quite deficient. Questions on breastfeeding were included only in more recent inquiries--the NIHR and CPS. However, the data are more consistent for the purpose of calculating Bongaarts' index of the effect of postpartum infecundibility on fertility than was the case with abortion. Mean or median months of breastfeeding are provided in reports on the NIHR and CPS by Anderson et al. (1981) and Berquo (1980), as shown in Table 14. Calculation of the Bongaarts index requires a transformation of mean or median months of breastfeeding to months of postpartum amenorrhea, which is the "i" in the formula for the index: $C_a = 20/18.5 + i$. Anderson calculated i for Bahia, Pernambuco, Rio Grande do Norte, and Paraiba using the Lesthaege-Page model schedules, and a formula based on this schedule was used to transform the remaining observations.

While not representative of the entire Brazilian population, the data in Table 14 do span a broad enough spectrum of experience, from poorer Northeastern areas to the industrialized Southeast and the more developed rural areas of the South, to permit speculation about a plausible national-level index. The index values in the table, as well as the breastfeeding data on which they are based, show that the practice of breastfeeding is

TABLE 14 Reported Breastfeeding, Summary of Survey Data: Brazil

Site of Survey	Date	Months of Breastfeeding		Months of Amenorrhea	Index C_i
		Mean	Median	Median	
Sao Paulo-Urban	1978		<1	2.0	.97
Sao Paulo-Rural	1978		7.4	4.4	.87
Piaui, Teresina	1979		3.3	2.7	.94
Piaui-Rest	1979		9.1	5.3	.84
Bahia, Salvador	1980	4.8	<1	2.9	.93
Bahia-Rest	1980	9.4	3.8	4.0	.89
Paraiba-Urban	1980	4.7	<1	2.4	.96
Paraiba-Rural	1980	5.5	1.8	3.2	.92
Pernambuco, Recife	1980	3.7	<1	2.2	.97
Pernambuco-Rest	1980	4.4	<1	2.1	.97
Rio Grande do Norte-Urban	1980	4.2	<1	2.5	.95
Rio Grande do Norte-Rural	1980	5.0	<1	2.8	.94
Cachoeira-Urban (ES)	1975	8.5		5.0	.85
Santa Cruz-Urban (RGS)	1975	4.2		3.0	.93
Santa Cruz-Rural (RGS)	1975	5.5		3.6	.90
Sao Jose-Urban (SP)	1975	6.0		3.8	.90
Sertaozinho-Rural (SP)	1975	7.3		4.4	.87
Recife-Urban (PE)	1975	3.3		2.7	.94
Conceicao A.-Rural (PA)	1975	8.5		5.0	.85
Parnaiba-Urban (PI)	1975	4.8		3.3	.92
Parnaiba-Rural (PI)	1975	6.3		3.9	.89

Sources: 1975 data from Berquo (1980:Table II); all other data from Anderson et al. (1981:Table 5).

very limited. Indeed, Brazil falls at the very low end of the spectrum of countries for which breastfeeding data are available, including Latin American countries, which have low rates compared to other regions of the world (Kent, 1981). The index values range from .84 to .97, with lower values (higher breastfeeding) in rural areas and higher values in the cities. Values are also higher in areas in which contraceptive use is higher, suggesting that the practice of breastfeeding decreases as contraceptive use increases. These values are much more comparable to those of other industrialized countries than to those of developing countries; they are high even in comparison with other Latin American countries that also have higher values in comparison with other developing regions.

For purposes of computing an index of postpartum infecundability at the national level, an initial 1970 level of 4 months was assumed. Since there is evidence

to suggest that increased contraceptive use leads to a decrease in breastfeeding, the assumption was reduced to 3.5 months in 1976 and 3 months in 1980 in the national-level estimates of proximate determinants that follow.

A Speculative Overview of Trends in the Proximate Determinants of Total Fertility Rates, 1970-80

Table 15 links estimates of the total fertility rate to the total fecundity rate (assumed to be 15.3 births per woman), using the evidence on contraception, abortion, and postpartum amenorrhea presented in the previous three sections on Bongaarts' indices for each of these proximate determinants. It also incorporates the information on marriage rates discussed earlier in this chapter. Two variants are presented for each of the three observation points: one assumes the lower value in the range of estimates of the total abortion rate, with higher levels of contraceptive use (lower levels of the index of non-contraception); the other assumes lower contraceptive

TABLE 15 Estimates of Proximate Determinants of Total Fertility Rate, 1970-80: Brazil

Measure and Variant	1970		1976		1980	
	A	B	A	B	A	B
Assumptions						
Percent users (U)	0.32	0.25	0.47	0.41	0.52	0.46
Effectiveness (E)	0.80	0.80	0.86	0.86	0.88	0.88
Sterilization factor	1.10	1.10	1.125	1.125	1.125	1.125
Months of infecundity	4.0	4.0	3.5	3.5	3.0	3.0
Total abortion rate	0.5	1.5	0.5	1.5	0.5	1.5
Results[a]						
Total fecundity rate	15.3	15.3	15.3	15.3	15.3	15.3
Infecundity index	0.89	0.89	0.91	0.91	0.93	0.93
Natural marital fertility	13.6	13.6	13.9	13.9	14.2	14.2
Abortion index	0.96	0.88	0.94	0.84	0.93	0.82
Contraception fertility	0.72	0.78	0.54	0.60	0.49	0.55
Total marital fertility	9.34	9.39	7.04	7.03	6.42	6.42
Nonmarriage index	0.63	0.63	0.63	0.63	0.64	0.64
Total Fertility Rate	5.89	5.92	4.43	4.43	4.11	4.11

[a]Data in second panel have been rounded; total fertility rate based on data before rounding.

use, and the higher estimate of the total abortion rate. This is only one of several tradeoffs that a range of values in the abortion rate implies. Higher abortion rates could also imply less effective contraception, as well as a lower impact of nonmarriage to the extent that abortions are used to terminate the pregnancies of women outside of unions.

The underlying assumptions are summarized in the first panel of the table. The contraceptive use and effectiveness rates in variant "A" are based on Table 12. The reduction in the contraceptive use rate in variant "B" is proportional to the increase in the abortion index implied by the higher total abortion rate. Both variants assume that there is a decline in postpartum infecundity of about 0.5 months from 1970 to 1976 that relates to increased contraceptive use, with a similar decline for 1976 to 1980. No change is assumed between 1970 and 1976 in the index of nonmarriage, which is consistent with the observed trend for that period, while a small increase is shown for 1980.

In variant "A", the main factor accounting for the decline in the total fertility rate from its level of around 5.9 in 1970 to 4.4 in 1976 is the decrease in C_C; this reflects increased contraceptive use, as well as increased effectiveness deriving from a higher proportion of more effective methods (the pill and sterilization) among those used. To the extent that variant "A" understates the abortion rate, this conclusion should be modified by assuming a smaller increase in contraceptive use, less improvement in contraceptive effectiveness, or a lower level of nonmarriage. Variant "B" illustrates the first of these possibilities.

Extrapolating to 1980, the table suggests that the pace of the decline in total fertility could be slower in the last half of the decade. This is partly a result of using levels of C_C in 1976 large enough to account for the 1970-76 decline, combined with C_C values for 1980 that are consistent with the survey results reported in Table 11. Variant "B" suggests an even slower decline in C_C, assuming that abortions played a greater role in the decline in total fertility than is implied in variant "A." It is worth noting that special tabulations of the 1977 and 1978 PNAD survey data in fact suggest a slowing of the pace of the decline of total fertility (Leite, 1981). An alternative hypothesis is that flaws in the design of the 1976 survey produced an overstatement of the decline, a point that will prove difficult to test

until data for making alternative estimates of fertility during the decade become available (i.e., 1980 census data, for which the own-children method could be applied).

CONCLUSIONS

The 1970s brought a significant acceleration in the decline of fertility in Brazil: the crude birth rate fell from 41 per 1,000 in the late 1960s to 34 per 1,000 in the late 1970s; the total fertility rate, a more refined measure of fertility, declined from around 5.8 births per 1,000 women around 1970 to around 4.4 births by 1976. Of the three demographic factors that could account for a decline in the birth rate (proportions married, age structure, and marital fertility), declining marital fertility was clearly responsible for the change.

Assessment of the effect of nuptiality on fertility is complicated by the questionable reliability of reported marital status in the available census and survey data. A number of factors suggest that the proportion of younger women (up to age 25) reported as married has been understated. Doubts about the proportions married remain even after adjustments to include single women reporting births and separated women who might have entered into a second union and did not report it because divorce was not legally recognized. The whole question of pregnancies to women not in unions and the termination of such pregnancies remains a major area of doubt in examining the proximate determinants of Brazil's fertility decline. Calculations of the singulate mean age at marriage (SMAM) from census and survey data indicate a rise of about 0.8 years in the mean age at marriage between 1960 and 1970, and about half that from 1970 to 1976. An alternative measure of the age at which women begin being exposed to the risk of childbearing, the singulate mean age at first birth, reveals a similar trend. Even after adjustment of the marital status data to account for possible underreporting of the proportions married among women in their early twenties, there is little evidence of change between 1970 and 1976; this suggests that changes in marital status had only a limited effect on fertility decline during that interval. Because of the demographic echo of increased births in the 1950s and 1960s, the age structure of the Brazilian population had a slightly positive impact on birth rates.

Thus, on the basis of an admittedly speculative reconstruction of "what could have happened" when Brazil's accelerated fertility decline is decomposed into demographic components and into the proximate determinants of fertility, it can be concluded that a decline in marital fertility was the primary factor responsible. This decline in marital fertility can in turn be traced to an increased use of effective contraception, combined with an indeterminate abortion component both within and outside of marriage. Though national-level data on the proximate variables are lacking, survey data can be used to construct a national-level index of noncontraception, which declined from .72-.78 in 1970 to .54-.60 in 1976 and .49-.59 in 1980, suggesting that increased contraception played a major role in the decline. Survey data also indicate a very low prevalence of breastfeeding, and suggest a moderate attenuation of the fertility-reducing effect of postpartum amenorrhea as contraception increased. The major unknown variable is abortion. The more one accepts the fragments of evidence that abortion is widespread in Brazil, particularly among low-income groups, the more one must adjust the importance attached to increased contraception and no change in marriage rates.

Finally, it should be emphasized that doubts remain about the reliability of data on marital status, particularly since a significant number of pregnancies among women not in unions may be terminated by abortion, and informal unions may be formalized only after a live birth. Census and survey data on the proportion of women in unions may therefore reflect after-the-fact social adjustment processes more than the exact demographic accounting needed to decompose the proximate determinants of fertility.

CHAPTER 2

SOCIOECONOMIC DIFFERENTIALS IN FERTILITY

The evidence presented in Chapter 1 indicated that fertility had already declined prior to 1970 in more developed regions such as the Southeast, particularly among higher-income groups, but not among lower-income groups and regions. It also suggested that the overall accelerated decline after 1970 probably resulted from the spread of lower fertility to those latter groups. The objective of the present chapter is to identify these groups more precisely. This should make it possible to focus an explanation of the post-1970 accelerated decline more sharply on particular groups, and on specific socioeconomic changes that may have affected their reproductive behavior.

Evidence presented in this chapter is based on data from the public use sample of the 1970 census and the 1976 PNAD national sample survey, both of which include questions on average parity and on births in the year prior to the interview. Responses were tabulated by household income, education of women, rural-urban residence, and region. Indirect estimating techniques were used to derive total fertility rates for women in different education and income categories. Considerable caution is required in interpreting the results since most of the assumptions on which the techniques are based are violated in such an exercise. This problem is complicated by the fact that the severity of these violations can vary between categories of income and education into which the population has been grouped. For example, the assumption of constant fertility would be violated to a greater extent among higher income and education groups if they had been experiencing more rapid fertility decline than lower income and education groups--the situation in Brazil in 1970. Moreover, once the population has been

divided into education and income classes, these cannot be considered "closed" populations, another requirement for valid application of the techniques. Sampling error is a further problem when such divisions are made, particularly for reported births in the year prior to the interview. These biases can be reduced but not eliminated by using fewer categories of each variable to increase sample size. In the study of fertility differences by income category cited in Chapter 1, Carvalho and Paiva (1976) reported that such a procedure reduced the impact of interclass mobility on their estimates. This problem may be less serious for breakdowns of the population by education than by income since most women, except the small proportion with university education, would have completed their education by the time they reached their late teens.

EDUCATION AND FERTILITY DECLINE

To examine the relation between fertility and education, women were divided into three broad education categories, with education defined according to years of schooling completed: women with no schooling, those with 1-4 years of schooling, and those with 5 or more years. This breakdown sacrifices some specificity among higher educational groups for a reduction in sampling error and in the mobility bias mentioned above. In preliminary tabulations, the effect of education on fertility varied by rural-urban residence, suggesting that rural and urban women should be separated in the discussion of educational differences. To reduce the sampling error that resulted from having so few rural women with more than 4 years of schooling, only two rural education classes were created: "none" and "any education."

Computations of total fertility rates for women in different education groups are based on the adapted Brass methodology described in Indirect Techniques for Demographic Estimation (United Nations, 1983); in this method, reference period error in the reporting of births during the year prior to the census or survey is corrected using a factor derived from comparisons between reported parity at different ages and the parity that would accrue if current fertility were cumulated (P/F ratios). Although reference period error would be expected in the 1970 data, which are based on a question about births in the last year, that error should have been minimal in the

1976 survey, which recorded the date of the last birth. Estimates prepared for the Panel on Brazil indicated an average P/F of 1.32 for Brazil in 1970 and 1.22 in 1976; this falls to 1.07 in estimates of total fertility based on advanced tabulations of the 1980 census. The 1976 P/F ratios suggest that reference period error was still present; one reason for this is that the survey was conducted over several weeks, and the year interval identified in the tabulations may have excluded recent births. The Panel on Brazil elected to employ the P/F ratio adjustment in 1976, as discussed further in its report.

These problems, as well as the others mentioned above (interclass mobility, interclass differentials in recent fertility decline, and sampling error), have undoubtedly affected the results reported in Table 16, which presents estimates of total fertility for women grouped according to educational attainment and rural-urban residence. The results are arranged in separate panels for 1970 and 1976. The first row in each panel shows unadjusted rates based on reported births in the previous year; the second row gives the average P/F ratio for women aged 20-24 and 25-29. The unadjusted data suggest a strong negative correlation between years of schooling and total fertility. The question arises of whether reference period error was higher among less-educated women. In 1970, the P/F ratio was 1.37 for urban women with no education and about .10 lower for urban women with some education. It is doubtful that enough women in their twenties shifted from the "none" class to the 1-4 group for interclass shifts to have accounted for this. On the other hand, it is possible that the P/F ratio for the 5+ group may be exaggerated since these women had been experiencing more rapid fertility decline prior to 1970.

Although the 1976 results suggest that fertility decline has indeed spread to lower education groups, problems arising from P/F ratios make it very difficult to determine how much. Interclass shifting of women may have had a greater effect since P/F ratios dropped from 1.27 in the "none" group to 1.07 in the 5+ group at the same time that the percent of women in the "none" group declined from 13.6 in 1970 to 9.5 in 1976; the 5+ category increased from 22.1 to 30.7 percent. The 1976 results could also reflect higher reference period error among less-educated women. That survey's enumerators were better trained and supervised than those of the census, a point which suggests that reference period error, if present in 1976, could be related to the

TABLE 16 Total Fertility Rates by Years of Schooling, 1970-76: Brazil

Year and Measure	Total	Years of Schooling				
		Urban			Rural	
		None	1-4	5+	None	Some
1970						
Unadjusted TFR	4.37	5.02	3.77	2.28	6.31	5.27
P/F Ratio[a]	1.33	1.37	1.26	1.27	1.32	1.32
Adjusted TFR	5.81	6.90	4.74	2.91	8.31	6.94
Percent Distribution	100.0	13.6	27.6	22.1	20.8	15.9
1976						
Unadjusted TFR	3.64	4.51	3.26	2.22	5.99	4.63
P/F Ratio[a]	1.22	1.27	1.24	1.07	1.31	1.12
Adjusted TFR	4.42	5.70	4.06	2.37	7.84	5.18
Percent Distribution	100.0	9.5	28.2	30.7	12.9	18.7
Percent Decrease						
Unadjusted TFR	16.7	10.2	13.5	2.6	5.1	12.1
Adjusted TFR	23.9	17.3	14.5	18.6	5.7	25.4
Mean Age[b] at First Birth						
1970	23.28	21.86	22.75	25.04	21.95	23.48
1976	23.84	21.91	22.30	26.08	22.08	23.70

[a]Adjustments based on average of P/F ratios for women aged 20-24 and 25-29.
[b]Based on reported percent of women with zero parity, after El Badry correction of nonreporting women (see United Nations, 1983).

Sources: Derived from 1970 census and 1976 PNAD sample files.

ability to recall the date of the last birth. If so, education, rather than the quality of interviewing, would account for differentials in reference period error. However, if fertility actually did decline more rapidly between 1970 and 1976 among less-educated women, this, too, could have inflated their P/F ratio.

Educational differentials in fertility with and without the P/F adjustment can be summarized according to differences between rates for women reporting a given level of education and women with no education. In 1970, unadjusted total fertility for urban women with 1-4 years of school was 1.25 children lower than for women with no schooling, and 2.74 lower for women with 5 or more years of schooling. These differentials increased to 2.15 and

3.99 children, respectively, when rates were adjusted using observed P/F ratios. The differential between rural women with no education and some education was one child when unadjusted data were used, and 1.37 children with the adjustment; though rural P/F ratios are equal, the adjustment process increases the differential between the two groups because of the larger base rate for women with no education. In 1976, the differential between unadjusted fertility rates for urban women with no education and those with 1-4 years of schooling was again 1.25 children, but decreased to 2.29 children for the 5+ group. With the adjustment, the differentials were 1.64 children and 3.33 children, respectively. Either way, educational differentials in fertility appear to narrow among urban women (when these differentials are expressed in numbers of children). For rural women, the opposite is true, since the 1976 differential was 1.36 with unadjusted data and 2.66 after the adjustment (see Figure 7).

The pattern of differentials in fertility decline between 1970 and 1976 is highly sensitive to P/F adjustments. For urban women, the category that appears least affected is the 1-4 group, whose decline was about 14 percent; however, its P/F ratios could have been biased upward both by fertility decline and by population shifts. For women with no education, the decline increases from 10 percent in the unadjusted rates to 17 percent after adjustment. For women with 5+ years of schooling, the decline increases from 3 percent to nearly 19 percent; the P/F ratio drops from 1.27 in 1970 to 1.07 in 1976 for that group. Although the results for rural women with no education are not affected by the adjustment, it causes the decline for rural women with some education to double.

It is difficult to draw firm conclusions about educational differentials in fertility decline from these results. For urban women, unadjusted data suggest that declines were greatest for women with 1-4 years of school. Adjusted results suggest that declines were greater among women with 5 or more years of schooling. Since there is reason to suspect that the 1970 P/F ratio for women in the 5+ group was biased upward by declining fertility, the 1970-76 decrease indicated by the adjusted data is probably exaggerated. A conclusion, tentative at best, is that urban fertility decline was probably more rapid among women with less education, leading to a narrowing of educational differentials among urban women; for rural women, those with no education experienced the least decline, leading to a widening in these differentials.

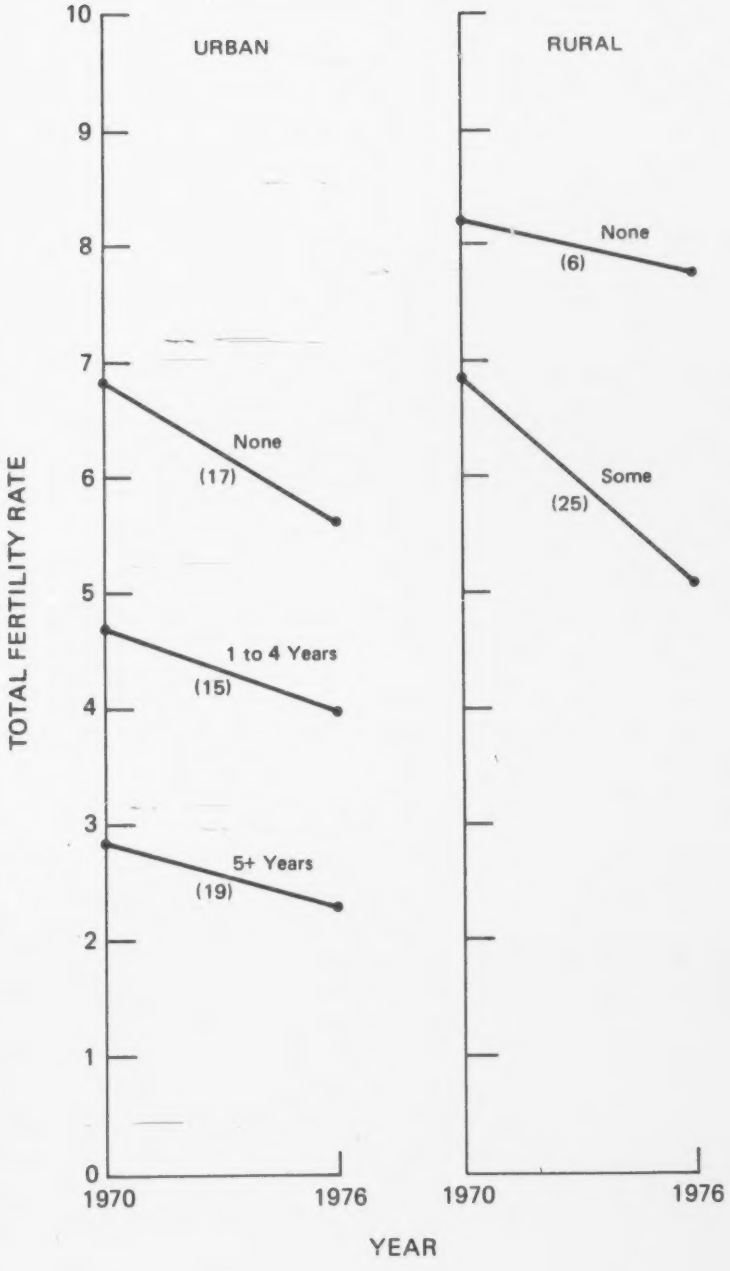

FIGURE 7 Total Fertility Rate by Years of Schooling, 1970 and 1976: Brazil

Note: Percent decreases shown in parentheses.

It is also important to observe that the total percentage fertility decline between 1970 and 1976 exceeded the decline in all but one education/residence category (the adjusted rates for rural women with some education). This is because the percentage distribution of women among education/residence categories changed between 1970 and 1976. The percentage of women in the urban "none" class declined from 13.6 percent to 9.5 percent, while the rural "none" dropped from 20.8 percent to 12.9 percent. The shares of the urban 5+ class increased from 22.1 percent to 30.7 percent, while the rural "some" group rose from 15.9 to 18.7 percent. The urban 1-4 group was more stable in percentage terms, though it is important to recognize that this stability masks considerable shifting into and out of the group as a consequence of changes in the shares of adjacent groups. Because of these changes in composition, the average decline for all classes combined exceeds percentage declines within classes.

Insights into the relationship between education and fertility that can be extracted from tabulations of questions on children ever born and children born in the last year are not limited to computation of total fertility rates. Tabulations of first births from these data make it possible to measure educational differences in the singulate mean age at first birth using the technique described earlier. These averages are shown in the last panel of Table 16. In 1970, there is a difference of less than one year between urban women in the "none" category and those with 1-4 years of schooling. A much larger difference, 2.3 years, separates the 1-4 and 5+ groups. There is a differential of about 1.5 years between rural women with no schooling and those with some schooling.

The main change in 1976 is that the average age at first birth for urban women in the 5+ group increases to 26.1 years, while the average for women in the 1-4 group drops slightly, increasing the difference between these groups to nearly 4 years. Since the reliability of these measurements could have been affected by the shifting of women from one education group to the next, by declining fertility, and by sampling error, caution is required in interpreting them. However, it is probably safe to say that these differences in age at first birth are one of the main features of educational differentials in Brazilian fertility. This could be the result of later marriage, labor force participation, and other aspects of

the changing roles associated with increased education. Educational differences in the singulate mean age at marriage measure were not computed because of previously mentioned doubts about the reliability of the reporting of marital status.

FAMILY INCOME

Published results of the 1976 PNAD survey included tabulations of fertility questions according to household income categories (in multiples of the monthly salary at the time of the survey). Berquo (1980) has compared estimates of total fertility based on these tabulations to estimates of fertility by minimum salary groups in 1970 census data, with results as shown in Table 17. These estimates suggest that the greatest decline in total fertility between 1970 and 1976 occurred among the lowest-income groups. This suggests important changes in the pattern of income-related fertility differentials in Brazil because declines prior to 1970 clearly had been concentrated in higher-income groups. These changes have stirred considerable interest in the question of why rapid fertility decline spread to low-income women. Before this question is explored in detail in subsequent chapters, the remainder of the present chapter describes more precisely

TABLE 17 Total Fertility Rates by Family Income Level (multiples of monthly minimum salary), 1970 and 1976: Brazil

Monthly Income: Multiples of the Minimum Salary	Total Fertility Rate		Percent Decline
	1970	1976	
≤ 1	7.66	6.11	20.2
< 1 to ≤ 2	6.20	5.94	4.2
< 2 to ≤ 5	4.35	4.07	6.4
> 5	2.60	2.54	2.3

Source: Berquo (1980), using 1970 census and 1976 PNAD survey data.

changes in the relationship between income and fertility in Brazil.

There are several ways in which the rates reported in Table 17 are ambiguous or might have been distorted. One relates to the effect of changes in the composition of women by income class. Again, in no group, including the lowest-income, does the decline exceed the 24 percent average for all groups combined, suggesting that changing composition has been at work. The effects of changing composition by income class are more complicated than the changes in education described above. There is an added problem of definition: the meaning of minimum salary categories as indices of poverty or wealth changed over the period from 1970 to 1976 because of deterioration in the purchasing power of the minimum salary; thus fertility changes observed for a particular minimum salary class could reflect the movement of women into or out of the class, or changes in the way that the class reflects income distribution. In 1970, 39 percent of families reported income levels of one minimum salary or less, and 21 percent had two or more. By 1976, the share of families with less than one minimum salary had fallen to 21 percent, while those with two or more had increased to 54 percent. The extent to which these shifts represent interclass mobility rather than changes in the meaning of minimum salary classes is ambiguous. Either could explain why the largest fertility declines seem limited to the lowest minimum salary group. Nearly half of the women in the one-two class in 1976 belonged to the less than one class in 1970, which means that they could well have experienced a decline from 7.66 to 5.94 (22 percent), a figure that is closer to the national average.

Another ambiguity relates to the extent to which these changes in composition, as well as interclass differentials in prior fertility decline and sampling error, may have distorted P/F ratios used to adjust total fertility rates reported in Table 17. If the tabulations by educational level are a valid indication, there could be major problems.

A third ambiguity, also suggested by the education results, arises from the possible masking of quite different rural and urban patterns in income group averages that combine rural and urban women.

Access to the raw data files for both the 1970 census sample and the 1976 PNAD survey make it possible to experiment with alternative tabulations by income class aimed at reducing, or at least clarifying, these distor-

tions. To avoid the definitional problem arising from categorizing income groups according to minimum salary, families were regrouped into family income deciles (with families in multifamily households considered as separate units). In doing this, a choice had to be made between total family income and family income per capita. Neither measure was entirely satisfactory: for a given level of income, grouping by total income understated the relative prosperity of smaller households, whereas grouping by income per capita led to a clustering of higher-fertility women in the lower-income category. When total fertility rates for women categorized as low-income by both definitions were compared to results for women with no education, the rate for the low per capita category was higher, enough so that the grouping by total family income was selected.

In tabulating questions on fertility for different family income deciles, decile categories were grouped to reduce sampling error and the impact of interclass mobility. The following groups were adopted: in urban areas, deciles 1-3 were labeled "low," deciles 4-6 "middle," and deciles 7-10 "high"; in rural areas, the top two groups were combined because of sampling error arising from the limited number of cases in the 7-10 category. Interclass mobility is reduced but not eliminated by this grouping since the deciles refer to the distribution of all families, and the composition of groups could change as a result of changes in the distribution of women by place of residence or income.

Total fertility rates calculated from responses to fertility questions tabulated for groups of family income deciles are presented in Table 18. The format of the table is similar to that of Table 16, which described fertility differences by educational level: unadjusted rates in the first row, followed by observed P/F ratios, adjusted rates, and the percentage distribution of women in 1970 and 1976. The table also shows percentage decreases in rates from 1970 to 1976 and singulate mean ages at first birth for both dates.

In the unadjusted rates for 1970, total fertility for the urban low group was actually .4 children less than for the middle group. The reason that this did not show up in Table 16 is that in 1970, the majority of low-income women resided in rural areas, which weighs heavily in the overall low-income average. Unadjusted total fertility for urban women in the high-income class was over 2 children lower than for those in the middle class, and in

TABLE 18 Total Fertility Rates by Family Income Deciles, 1970-76: Brazil

Year and Measure	Total	Family Income Decile				
		Urban			Rural	
		Low	Middle	High	Low	High
1970						
Unadjusted TFR	4.37	4.36	4.75	2.69	6 71	4.99
P/F Ratio[a]	1.33	1.38	1.22	1.44	1.19	1.53
Adjusted TFR	5.81	5.99	5.82	3.88	8.00	7.66
Percent Distribution	100.0	10.8	16.5	35.8	17.8	19.1
1976						
Adjusted TFR	3.64	3.98	3.95	2.08	6.50	4.11
P/F Ratio[a]	1.22	1.10	1.14	1.45	1.03	1.45
Adjusted TFR	4.42	4.37	4.52	3.02	6.70	5.86
Percent Distribution	100.0	12.2	18.6	37.7	13.4	18.1
Percent Decrease						
Unadjusted TFR	16.7	8.7	16.8	22.7	3.1	17.6
Adjusted TFR	23.9	27.0	22.3	22.2	16.3	22.2
Mean Age[b] at First Birth						
1970	23.28	22.03	21.46	25.16	20.51	24.28
1976	23.84	21.32	21.52	26.30	20.48	24.70

[a]Adjustments based on average of P/F ratios for women aged 20-24 and 25-29.
[b]Based on reported percent of women with zero parity, after El Badry correction of nonreporting women (see United Nations, 1983).

Sources: Derived from 1970 census and 1976 PNAD sample files.

rural areas about 1.7 children lower for middle and high deciles combined. Unadjusted total fertility declined by about 17 percent overall from 1970 to 1976. Rates for the urban low and middle groups were about the same, and the pattern of differences among other groups was similar to that of 1970. The rural low group declined least; however, the weight of this group decreased, while that of low urban women increased. The unadjusted rates suggest that fertility decline was greater among the middle- and high-income groups.

The picture changes considerably when rates are adjusted using the observed P/F ratios: income differentials narrow for both urban and rural women because of the high P/F ratios of high-income women. This is surely a distortion that reflects the declining fertility of

women in this group. Because 1976 P/F ratios were lower for all women except those in the urban high-income group, the adjusted rates suggest more rapid declines than do the unadjusted rates. The pattern of fertility decline by income class also changes, with the adjusted rates indicating that decline to have been greatest among low-income urban women and least among low-income rural women. Though the P/F ratio of high-income women is probably distorted, there is little change in it from 1970 to 1976; thus the percentage decline for the group is unaffected.

The insights provided by these results about income class differentials in the level and percentage decline of fertility between 1970 and 1976 are thus clouded by distortions in the P/F ratios. However, they do suggest a need to modify the conclusion reported earlier that fertility decline was concentrated in the lowest-income group and that little or no decline occurred at higher levels. Moreover, the results indicate that if fertility decline was greater among low-income women, it was among low-income urban women; in fact, they suggest that the rate of decline was lowest among low-income rural women. Otherwise, the evidence reported here indicates that fertility decline was more evenly spread across income classes. If this is so, education may have played a more important role than income in differentials in the rate of decline between 1970 and 1976. There may also be an interaction between education and income; that is, fertility change may be related to a woman's level of education, but the nature of this relation may vary by income class.

The last bit of information about income class differentials in fertility relates to the measure of mean age at first birth. The patterns here are similar to those observed in the educational breakdowns, with a differential of about 3 years separating high-income women from other groups in 1970 and an increase in this differential to about 4 years for urban women in 1976. This again raises the question of what socioeconomic forces led to increases in age at first birth for these women and not for women in lower income and education groups; it also raises the question of how differences by income and education relate to each other.

A partial answer to the last question is provided by an examination of joint percentage distributions of women by educational attainment and family income level, as shown in Table 19. The base for the percentages is the total number of women aged 15-49; thus each cell in the

TABLE 19 Percent Distribution of All Women Aged 15-49 by Income Deciles, Years in School, and Rural-Urban Residence, 1970 and 1976: Brazil

Year and Income Decile	Years of Schooling				
	Urban			Rural	
	None	1-4	5+	None	Some
1970					
Urban Low	4.78	4.46	1.52	--	--
Urban Middle	4.93	8.27	3.26	--	--
Urban High	3.83	14.83	17.29	--	--
Rural Low	--	--	--	12.20	5.54
Rural High	--	--	--	8.73	10.36
1976					
Urban Low	3.74	5.79	2.62	--	--
Urban Middle	3.46	9.34	5.79	--	--
Urban High	2.32	13.10	22.27	--	--
Rural Low	--	--	--	7.21	6.20
Rural High	--	--	--	5.69	12.44

Sources: Tabulations of 1970 census and 1976 survey data files.

table shows the percent of women in a particular income/education group, with the sum of all cells rather than either rows or columns adding to 100 percent. The distributions show that there is a loose correspondence in the data, but hardly an exact fit, between income level and educational attainment. This correspondence, measured by comparing percentages in each cell, is closer when one examines the distributions of educational attainment within income groups (reading across rows); the picture is less clear in the distribution of women by income level within education categories (reading down columns). There is a closer correspondence in rural areas and at higher levels of income and education in the urban population: for example, the majority of women with higher educational attainment are found in higher-income deciles. This is not true of urban women with

lower educational attainment, who appear to have a better chance of attaining the middle- or upper-income deciles. This indicates a need to take account of the role of education and other features of the urban environment (particularly labor force participation) in examining differentials in fertility by income class, and vice versa.

THE REGIONAL DIMENSION OF INCOME DIFFERENCES

The regional dimension of declines in total fertility by income level is examined in Table 20.[1] Rates were calculated for three groups of PNAD regions, which were combined to preserve an adequate sample size in the tabulation by income deciles. Regions 1 and 2 (Rio de Janeiro and Sao Paulo), which represent the highest levels of income and socioeconomic development in Brazil, were combined and are labeled as "RJ-SP". A second combination consists of PNAD regions 3 and 4 (Parana/Santa Catarina/Rio Grande do Sul and Minas Gerais/Espirito Santo), which represent intermediate levels of income and other development indicators and are labeled as "Other." Region 5 consists of Brazil's poorest region, the Northeastern states, so labeled. PNAD regions 6 and 7 are not shown because only their urban population was available in the 1976 sample. Family income groups were also consolidated to reduce sampling error: in urban areas, the lowest six and highest four deciles were combined, and all rural women were combined. The discussion is limited to unadjusted total fertility rates.

In 1970, previously observed (Chapter 1) patterns of interregional differentials in fertility were maintained within each broad category of family income. Fertility was lowest in the high-income region and highest in the low-income region. Interregional differentials were greatest among low-income urban women. Within regions, the differential between low- and high-income urban women was greatest in the Northeast and least in Rio and Sao Paulo. However, the differential between low-income urban women and rural women generally (most of whom are lower-income) is greatest in the middle group.

In 1976, the pattern changed. Most importantly, rates for women in middle-income regions moved closer to those for women in Rio and Sao Paulo. In fact, the rates for urban low-income women were lower in the "other" region, so that the within-region differential for urban women

TABLE 20 Unadjusted Total Fertility Rate by PNAD Region and Income Decile, 1970 and 1976: Brazil

Year and Decile	PNAD Region		
	RJ-SP (1-2)	Other (3-4)	Northeast (5)
1970			
Urban/Low-Middle	3.85	4.27	5.41
Urban/Middle	2.47	2.67	3.37
Rural/All	4.82	5.62	6.39
1976			
Urban/Low-Middle	3.51	3.32	4.85
Urban/High	2.01	2.04	4.43
Rural/All	4.42	4.43	6.06
Percent Decrease			
Urban/Low-Middle	8.8	22.2	10.4
Urban/High	18.6	23.6	29.1
Rural/All	8.3	21.2	5.2

Source: Unadjusted total fertility rates derived from special tabulations of census and survey files.

was less for this region than for RJ-SP. The reason for this is that fertility rates for all classes of women declined more rapidly in the former. Declines were least rapid in Rio and Sao Paulo since their rates were lower to begin with in 1970. The greatest percentage decline occurred among high-income urban women in the Northeast, while the lowest percentage decline was among rural women in that region.

In assessing these patterns, it is also important to take account of the relative size of each region's income classes, since both the percentage decline and weight of each group in the total number of women account for their contributions to the overall fertility decline. Table 21

TABLE 21 Percent Distribution of Women Aged 15-49 by PNAD Region and Income Deciles, 1970 and 1976: Brazil

Year and Decile	PNAD Region				
	RJ-SP	Other	Northeast		
	(1-2)	(3-4)	(5)	(6-7)	Total
1970					
Urban/Low-Middle	7.8	7.8	9.2	2.5	27.3
Urban/High	19.9	9.0	4.7	2.2	35.8
Rural/All	4.6	15.5	16.8	a	36.9
Total	32.3	32.3	30.7	4.7	100.0
1976					
Urban/Low-Middle	9.7	8.7	9.7	3.1	31.2
Urban/High	19.7	10.7	4.7	2.3	37.4
Rural/All	3.7	13.2	14.5	a	31.4
Total	33.1	32.6	28.9	5.4	100.0

[a]Regions 6-7 included for comparison, but rural population of these regions not included in total.

Source: Special tabulations of census and survey data files.

shows the percentage distributions of women aged 15-49 by region and income class for 1970 and 1976. The total number of women at each date is the base of the percentages. The group with the largest share (nearly 20 percent) of women--the higher-income deciles in Rio and Sao Paulo--had an 18.6 percent fertility decline. Although this was below the national average since this group already had comparatively low fertility in 1970, it was important because of the weight of this group in the total. The group with the greatest percentage decline in fertility--the higher-income women in the Northeast--accounted for a relatively small share (less than 5 percent) of women (see Figure 8).

The important groups in terms of larger weight in the total and higher percentage declines were women in the middle-income "other" region. They accounted for a little less than one-third of all women, and experienced

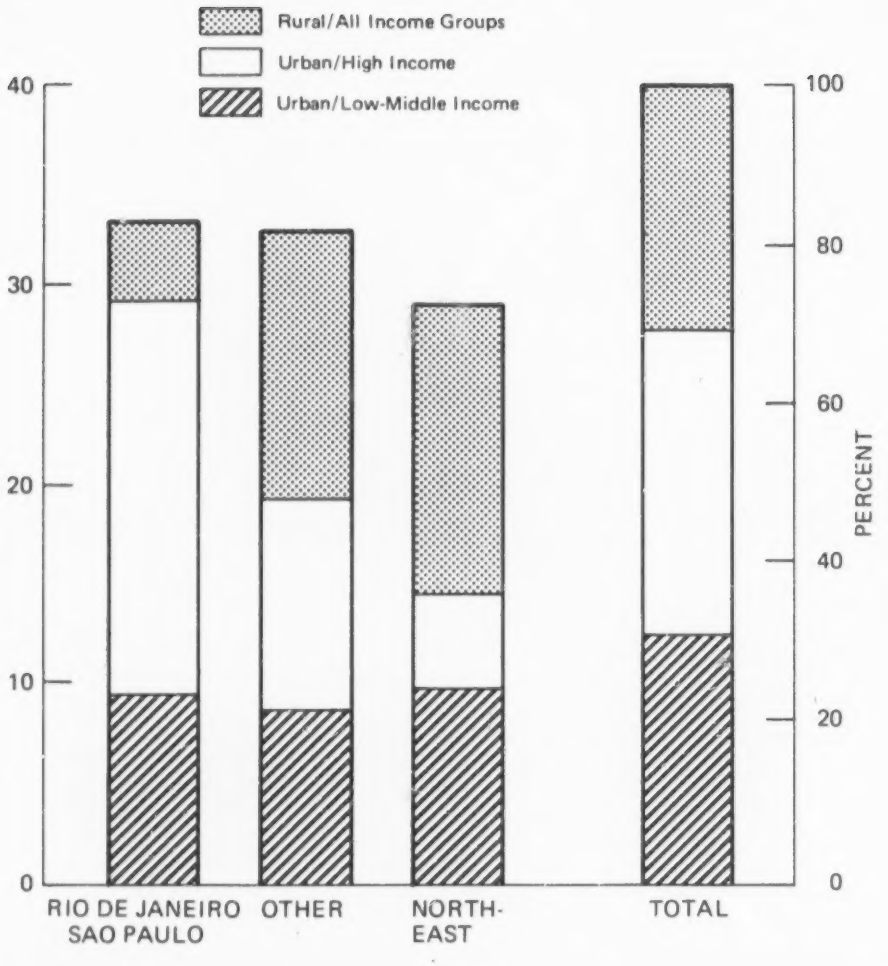

FIGURE 8 Distribution of Women Aged 15-49, by Region and Income Group, 1976: Brazil

fertility declines of 21-24 percent. Rural fertility decline in this region was about 22 percent, and these rural women accounted for about 14 percent of the total. This contrasts with rural women in the Northeast, whose decline was only 5 percent, and who accounted for a roughly similar percentage share of all women.

These comparisons add further weight to the conclusion stated earlier: that the spread of fertility decline to new regions and income groups, combined with its continuation among women experiencing pre-1970 declines, accounted for the accelerated fertility declines of the 1970s.

These comparisons also suggest that in the future, fertility decline at the national level will depend to an even greater extent on declines among low-income groups in both urban and rural areas. Fertility decline among urban middle- and upper-middle deciles, which contributed substantially to the declines of the 1970s, will be more limited since the fertility of these groups has reached comparatively low levels.

CONCLUSIONS

The objective of this chapter was to identify differences in fertility among Brazilian women according to levels of educational attainment and family income in 1970 and 1976, as well as differential rates of fertility decline between these two sets of data by education and income. A further objective was to determine the possible effects of changes in the distribution of women by education and income on the overall rate of decline and to pinpoint which groups contributed most to the decline because they had greater percentage declines, greater weight in the total number of women aged 15-19, or both.

The main finding of the chapter is a confirmation of the hypothesis stated in Chapter 1 about the reason for Brazil's accelerated fertility decline in the 1970s: during the 1970s, there was continued, though slowing, fertility decline among middle- and upper-income women in Rio de Janeiro and Sao Paulo (women who had experienced declines prior to 1970), combined with the spread of fertility decline to women in lower- and middle-income regions that had experienced only limited decline before 1970. The chapter also suggests a number of lines of analysis that might indicate why the 1970s brought the particular combination of fertility declines that it did. These data, while basically descriptive, suggest that interactions between income level, educational attainment, age, and other aspects of the socioeconomic environment should be studied in greater detail. An examination of links between female labor force participation, migration, and household consumption patterns is warranted, with account taken of regional and rural-urban dimensions of these changes. These factors will be included in the analyses presented in the next two chapters.

The present chapter has also raised a number of methodological questions, particularly about the reliability of data on births in the year prior to the interview as

tabulated for subpopulations like the income and education groups identified here. The distortions in P/F ratios associated with the shifting of women between groups, differential fertility between groups, and sampling error are so severe that adjustments based on these ratios are questionable if not misleading. Though it would be desirable to use data on current rather than cumulative fertility in analyzing recent changes, the questionable reliability of current fertility measures as applied to subpopulations suggests that data on parity by age and other characteristics are more likely to yield unbiased results. Imaginative use of these data, such as a focus on childlessness and on cohort changes (for example, the difference between the average parity of women in a particular education/income class who were 20-24 in 1970 and the parity of the same group at age 26-30 in 1976) may be a way to compensate for some of the information on recent fertility that is lost by not using the data on births in the last year.

CHAPTER 3

DETERMINANTS OF BRAZIL'S RECENT FERTILITY DECLINE

During the 1970s, marital fertility in Brazil declined by about 30 percent. Previously, it had been stable or decreased only slightly, though there were declines among women in higher-income classes. What accounts for this major shift in Brazilian reproductive patterns? A working hypothesis is that the change was triggered by the convergence of two sets of forces. One of these was the increased availability of effective means of contraception, particularly for lower-income groups and regions of the country that had not participated in the earlier fertility decline. The other was the emergence of socioeconomic conditions conducive to smaller family norms, which motivated couples to use available contraception to reduce, delay, or end childbearing.

The decomposition of the Brazilian fertility decline during the 1970-76 period presented in Chapter 2 of this report identified increased use of effective contraception as the key proximate variable determining that decline. The questions raised by this finding relate to the way access to fertility control increased in a country providing no official support for fertility control at the national level, as well as what factors motivated people to make use of available contraception when previously they had not.

Rapid fertility decline began during a period (1967-73) when the Brazilian economy was experiencing a very rapid rate of growth in aggregate income per capita, and accelerated when the boom faltered as a result of rising energy costs after 1973. In this period, Brazil also made major strides in achieving increased educational attainment for women (and men); moreover, important changes in social structure were occurring, including very rapid urbanization, increased female labor force participation, and

increased exposure to mass communications. At the same time, declining fertility took place in a society characterized by a very unequal distribution of the benefits of growth, and among groups that profited least from the boom and whose relative economic position may actually have deteriorated during this period. This raises the question of how modernizing forces, combined with changes in the capability to realize childbearing and other economic and social expectations, have influenced reproductive norms and behavioral patterns among the groups that contributed to fertility decline.

Brazil's diversity of regions and social classes, together with associated differences in the level and pace of change in demographic variables, would suggest that multiple changes in socioeconomic and demographic variables led to the accelerated fertility decline of the 1970s. This chapter examines hypotheses and supporting evidence used to explain recent shifts in Brazilian reproductive behavior, focusing on the spread of contraceptive use to women in lower and middle socioeconomic classes who accounted for much of the accelerated decline, and on socioeconomic changes that might explain this change in contraceptive use.

First, it explores hypotheses linking socioeconomic conditions to fertility decline. Next, it examines the available data on changes in Brazil's contraceptive patterns, and on socioeconomic factors associated with those changes. Finally, because of the essential institutional differences between urban and rural women, the hypotheses and data linking socioeconomic factors to fertility decline are applied separately to these two groups.

HYPOTHESES LINKING SOCIOECONOMIC CONDITIONS TO FERTILITY DECLINE

A number of hypotheses about the effects of changing socioeconomic conditions on Brazil's fertility decline can be formulated. One of these, coming under the general heading of "modernization," refers to the influence on reproductive behavior of rising income, changes in the costs of children relative to other goods, and shifts in social norms and aspirations. This hypothesis emphasizes the role of income and costs of children and other goods, focusing on tradeoffs between the number of children and other goods (including child quality). These tradeoffs

are influenced by increases in the value of women's time as they achieve higher levels of education, by related changes in the opportunity and direct costs of children (who are time-intensive compared to other goods), and by changes in overall household consumption patterns as a result of increased income and changing tastes. The logic of this hypothesis can be used to show that such changes lead to reduced demand for children and increased motivation to use family planning, particularly when the subjective and monetary costs of fertility control have fallen below those of an unplanned additional pregnancy.

A limitation of this framework is that there is no easy way to assess the influence of institutional forces at both the family and societal levels on reproductive norms and aspirations. This limitation is particularly important when fertility change is occurring in a context of rapid socioeconomic change. When only a few measures reflecting such changes are available, it may be difficult to identify the causal relationships between such variables and fertility. Female educational attainment and labor force participation are good examples. Education is strongly associated with fertility differentials, and is used in economic models as a measure of the value of time. However, education may also embody attitudes about women's roles, the value of children, and the practice of contraception. Increases in female labor force participation may indeed be responding to changes in female education and household income, but institutional forces that influence the labor markets in which jobs for women are available may also play an important role.

An institutional factor of particular concern in the Brazilian case is the distribution of income. It is true that during the period in which the decline of fertility accelerated, the rate of growth of per capita income was around 7 percent per annum; however, it should also be remembered that the distribution of the benefits of this growth was highly skewed. It is estimated that two-thirds of household income in Brazil accrued to the top 20 percent of households in 1972, with only 7 percent going to the lowest 40 percent (World Bank, 1981:Table 25). The 20 million people (20 percent of the Brazilian population in the early 1970s) with incomes growing more rapidly than Brazil's already impressive national average represent a substantial force in the direction of modernization, whose impact on fertility was clearly evident in the data presented in Chapter 2.

Nevertheless, lower-income groups experienced the most rapid fertility declines after 1970. To use the term "modernization" to characterize the social and economic changes that accompanied these declines seems incongruous with the living conditions implied by their position in Brazil's income distribution. While there is still considerable debate about the interpretation of Brazilian income distribution data, particularly with reference to nonmonetary items and the impact of inflation on the welfare of the poor, there is general agreement on points that are relevant to the question of fertility decline. One is that there are substantial numbers of people and families who are poor in the absolute sense of living with substandard levels of health, housing, nutrition, and other basic needs. Lluch (1981) estimates that the lowest three deciles of families classed by family income per capita in 1970 fell into this category, and that they were located in both rural and urban areas. A second point is that inflation has had an adverse impact on the buying power of lower-income groups. This is a result of the way in which the Brazilian system of wage and price indexing operated during the late 1960s and early 1970s, with the indices that controlled prices and credit obligations being allowed to increase more rapidly than the wage index. Lower-income groups suffered the most from this, and particularly hard-hit were urban working class families (the lower-middle income deciles), whose incomes were more closely linked to the wage index by virtue of employment in sectors governed by minimum salary arrangements.

The fact that fertility declines in the early 1970s were concentrated among the absolute poor and the lower-middle income families has suggested alternative hypotheses about the link between deterioration in buying power and reproductive behavior. Berquo (1980) has argued that the living conditions of the poor deteriorated so much during this period that their psychological and physiological capacity to reproduce was affected--a sort of "immiseration" hypothesis. She suggests that poor nutrition, fatigue associated with the need to work long hours to earn enough income to buy food, and poor nutrition may have caused a loss of the will to reproduce, a reduction in coital frequency, and a possible reduction in fecundity. However, assessment of such effects would require much more in-depth interviews than those available from the Contraceptive Prevalence Surveys (CPS). Certainly, the threshold at which amenorrhea and anovu-

lation are caused by malnutrition and psychological stress is high enough that such effects would be observed only in extreme circumstances. Still, it is possible that the fecundity of very low-income Brazilian women could have been affected by poor nutrition. A national nutrition and household consumption survey taken in 1974-75 provides nutritional indices for children under age 18. That survey indicated that 37 percent of Brazilian children were affected by first degree malnutrition (average body weight 76 to 90 percent of FAO/WHO norms), 20 percent by second degree malnutrition (61 to 75 percent of the norm), and 1 percent by third degree malnutrition (less than 60 percent of the norm) (World Bank, 1979). While data on mothers were not provided, such indices suggest that subfecundity may have affected a portion of low-income women. The possibility that physiological and psychological factors were involved in the fertility decline among Brazil's low-income groups should therefore not be ignored; however, it appears unlikely that they would account for a significant share of that decline.

Another hypothesis draws on elements of the modernization framework outlined above, but stresses increased economic pressures on the buying power of low-income households as a key determinant of changes in reproductive behavior. Carvalho et al. (1981) have argued that pressures to preserve living standards in the face of adverse economic conditions have forced poor families to adapt by delaying or curtailing their reproductive aspirations. In such circumstances, couples recognize that they cannot afford another child because of its direct impact on their limited income, as well as its opportunity cost in the time of mothers who must work to supplement family income. With increased accessibility, knowledge, and acceptability of contraception, fertility control is one of the few options available as a survival strategy; the decline of fertility among lower-income families is seen as an indication that they are choosing this option.

Extending this argument, it has been suggested that lower- and middle-income families, particularly in urban areas, raised their consumption expectations during early stages of Brazil's economic boom and were beginning to realize those expectations through increased purchases of housing, consumer durables, and even automobiles. Most of these purchases were made with small down-payments and required extended installment payments that were subject to Brazil's indexing system. Unequal treatment of credit

obligations and wages in the indexing process forced these families to allocate an increasing share of their monthly income to those installment payments. In these circumstances, avoiding the expense of an additional child, again given increased accessibility, knowledge, and acceptability of contraception, was an option. The rapid decline of fertility among these groups suggests that this may indeed have been their response.

The hypotheses summarized in the preceding paragraphs suggest a number of mechanisms through which changes in socioeconomic conditions in Brazil during the 1970s could have contributed to the acceleration of fertility decline. These hypotheses suggest differing views of the process in that the "modernization" hypothesis focuses on changes in couples' reproductive aspirations and their ability to realize them, while hypotheses focusing on economic pressures and structural change place greater emphasis on institutional forces. However, the various hypotheses are not necessarily competitive. In fact, given the range of changes in fertility observed at both the regional and socioeconomic class levels, it is likely that recent experience reflects a combination of reinforcing factors rather than any single mechanism.

Data with which to test any of these hypotheses are very limited. Most of the evidence provided by the 1970 census and 1976 survey data consists of broad measures having a bearing on several of the hypotheses; none of these measures offers the precision needed to specify causal models in support of one hypothesis to the exclusion of the others. At the same time, the data suggest that socioeconomic changes consistent with such explanations were in fact occurring. The next two subsections examine the data available on the primary aspects of the hypotheses presented above: increased accessibility, knowledge, and acceptability of contraception, and socioeconomic factors related to changing patterns of contraceptive use.

Increased Access to Fertility Control

While Brazil is one of the few developing countries without a national policy in support of fertility control, Brazilian women are not necessarily denied access to fertility control. In fact, the private sector has played a major role in increasing the availability of contraceptives in Brazil, both through commercial channels

and through private agencies, the most important being Brazil's International Planned Parenthood Federation (IPPF) affiliate Sociedade Civil Ben-Estar Familiar no Brasil (BEMFAM).

Commercial distribution networks were an important factor in the fertility decline among Brazilian middle- and upper-income classes prior to 1970, with pills, condoms, and surgical sterilization being the most common means adopted. Pills are manufactured in Brazil, with an increase in annual production from 1.7 million cycles in 1964 to 61.2 million in 1980. The largest percentage growth occurred during 1964-70, when there was an eight-fold increase to 13.5 million cycles. The following six years, 1970-76, brought a larger absolute increase to over 49 million cycles, nearly four times the 1970 level. This trend is shown graphically in Figure 9. Regionally, the market for pills has been concentrated in the Southern and Southeastern states. Regional shares of the total market are also shown in the figure, with separate panels for Sao Paulo, Rio de Janeiro, Minas Gerais, the three Southern states (Rio Grande do Sul, Santa Catarina, and Parana), and the remaining states in the Northeastern, Northern, and Central-West regions. Sao Paulo alone accounts for over 30 percent of the market; when its share is combined with that of Minas Gerais and Rio de Janeiro, the figure is close to 60 percent. The contribution of traditional methods such as withdrawal and periodic abstinence is also significant, even though these are less effective means.

BEMFAM has played an important role in extending access to modern methods, particularly the pill, to lower-income groups and regions. According to industry sources, 9 percent of pills produced in Brazil in 1976 were distributed to BEMFAM. Several state governments, including five in the Northeast, have entered into cooperative agreements with BEMFAM for the provision of community-based family planning services. While the number of women served by such programs is not large enough to account for all of the increase in contraceptive use that has been observed, BEMFAM's impact is clear from a comparison of data for states in which it is active with those in which it is not.

Another important factor in increased access is what appears to be a significant but not highly publicized shift in the attitude of the Brazilian public health care system toward the provision of family planning services and surgical sterilization. Though the Brazilian govern-

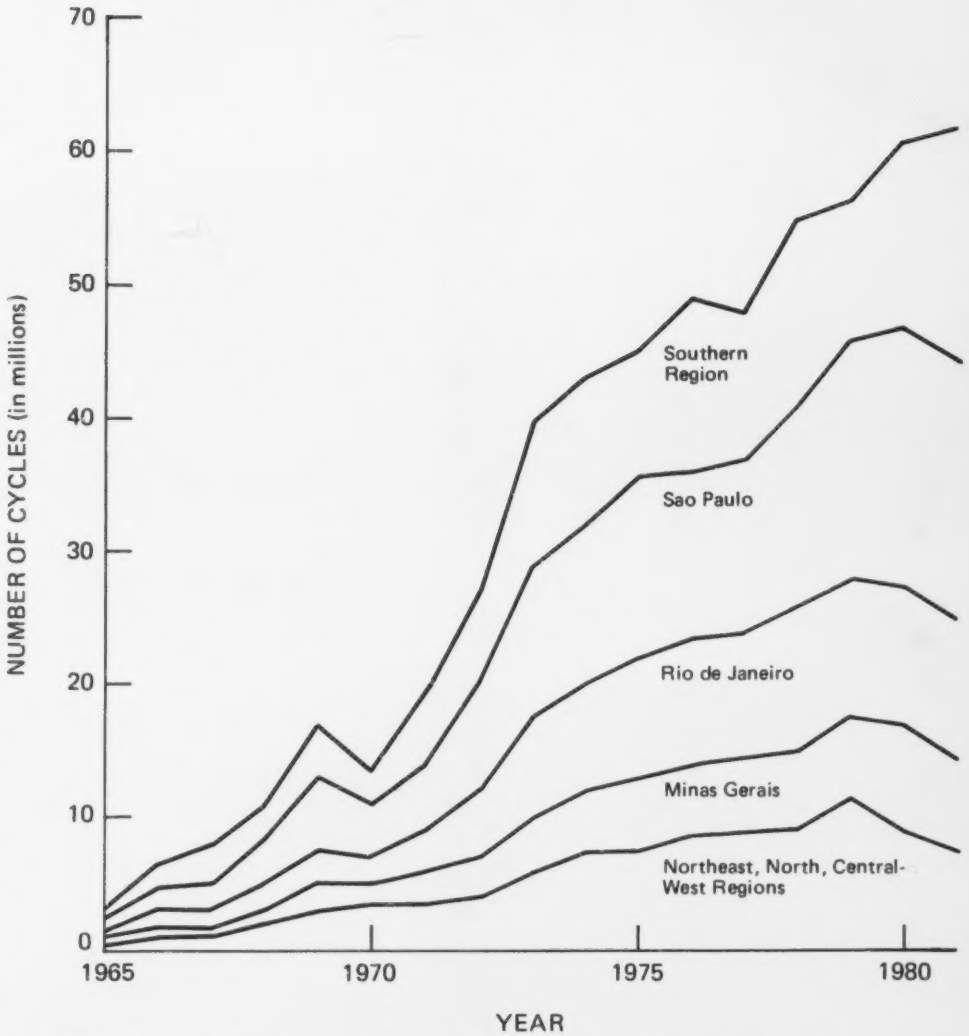

FIGURE 9 National and Regional Trends in Commercial Distribution of Contraceptive Pills, 1965-81: Brazil

ment has not yet adopted a national health plan that would eventually include family planning among its services, the health care system appears to have adopted a more liberal approach than it had before, at least in allowing private physicians working within the system to prescribe oral contraceptives and perform sterilizations.

The main sources of statistical data on contraceptive use in Brazil are the state-level Contraceptive Prevalence Surveys (CPS) and the local-level CEBRAP National Investigation on Human Reproduction (NIHR). Since the latter

is discussed in detail in Part II, the present chapter focuses on the CPS results. It should be noted that because none of these surveys was conducted prior to 1976, they provide an ex post view of the impact of increased access to family planning on fertility decline. Table 22 presents the percentage distributions in five of these surveys of married women aged 15-44 by household income level and contraceptive use status. The first row of figures for each survey shows that the percentage of women currently using contraception increased with household income, which is broken down in multiples of the average monthly minimum salary. The contraceptive use differential between women in upper- and lower-income groups was least in Sao Paulo, Brazil's most urbanized and industrialized state, and greatest in Bahia, located in the lower Northeast. The remaining states shown in the table are also located in the Northeast. Through cooperative arrangements with state governments, BEMFAM has operated community-based family planning programs (CBPs) in Rio Grande do Norte since 1973, followed by programs in Pernambuco and two other Northeastern states in 1976, and in Piaui in 1979.

Survey results for Rio Grande do Norte, the state in which the CBPs had been operating longest, indicate that the differential between higher- and lower-income women was less than that in Piaui and Bahia, states in which such programs did not exist prior to the survey. As for contraceptive methods, a higher proportion of women in upper-income groups had been sterilized, particularly in the Northeast; pills were more important relative to other methods among lower-income women. This is especially evident in Rio Grande do Norte, where pill users accounted for 43 percent of women currently contracepting in the low-income group, and 25 percent of high-income contraceptors. Sterilization, in contrast, accounted for 22 percent of low-income current users and 47 percent of high-income users. Other methods, mainly rhythm and withdrawal, were also important among low-income current users; these methods, along with condoms, were important as well among low-income women in the state of Sao Paulo.

When educational attainment is substituted for income as the measure of socioeconomic differences in contraceptive use, the results are virtually identical, at least for the four states with available tabulations on which to base a comparison. Table 23 shows the percentage of currently married women aged 15-44 using contraception for four education categories, ranging from none to some

TABLE 22 Percent Distribution of Married Women Aged 15-44, by Contraceptive Use Status and Household Income: Brazil

State and Date	Multiples of Minimum Salary				
	<1	1-2	2-4	5+	Total
Sao Paulo (1978)[a]					
Currently Using	47.4	57.4	67.4	68.5	63.9
Orals	6.4	28.9	34.0	22.0	27.8
Sterilization	5.4	11.0	15.2	22.0	16.1
Other	35.6	27.5	18.2	24.5	20.0
Not Using	53.6	42.6	32.6	31.5	36.1
Total	100.0	100.0	100.0	100.0	100.0
Rio Grande do Norte (1980)					
Currently Using	37.0	46.6	53.4	72.9	47.0
Orals	15.9	18.2	20.9	22.9	17.9
Sterilization	8.4	17.3	23.1	34.4	17.4
Other	12.7	11.1	9.4	15.6	11.7
Not Using	63.0	53.4	46.6	27.1	53.0
Total	100.0	100.0	100.0	100.0	100.0
Piaui (1979)					
Currently Using	25.1	30.5	42.6	57.0	30.9
Orals	9.3	10.5	12.7	17.1	10.0
Sterilization	9.9	14.9	25.5	34.1	15.4
Other	5.9	5.1	2.4	5.8	5.5
Not Using	74.9	69.5	57.4	43.0	69.1
Total	100.0	100.0	100.0	100.0	100.0
Pernambuco (1980)					
Currently Using	26.2	32.4	46.5	62.9	41.4
Orals	8.0	10.6	13.0	16.4	12.5
Sterilization	9.1	12.9	22.9	40.2	18.9
Other	9.1	8.9	10.6	6.3	10.0
Not Using	73.8	67.6	53.5	37.1	58.6
Total	100.0	100.0	100.0	100.0	100.0

TABLE 22 (continued)

State and Date	Multiples of Minimum Salary				
	<1	1-2	2-4	5+	Total
Bahia (1980)					
Currently Using	18.7	28.4	42.8	65.9	31.1
Orals	6.9	13.5	15.3	15.7	11.7
Sterilization	7.1	7.4	13.2	26.3	9.6
Other	5.7	7.5	14.3	23.8	9.8
Not Using	81.3	71.6	57.2	34.1	68.9
Total	100.0	100.0	100.0	100.0	100.0

[a]Source breaks Sao Paulo data by more detailed income classes. Weighted averages were used to collapse income categories for Sao Paulo into classes that were comparable to those reported for other states. Since cell weights were not available, figures may differ from those derived from direct tabulation using collapsed income classes.

Source: Rodrigues et al. (1981a:Table 7).

secondary or more, in Piaui, Pernambuco, Rio Grande do Norte, and Bahia. Percentages for the "none" group are quite similar to those for the lowest-income groups in the respective states, with those for the "secondary and over" category falling somewhat below what was observed for the 5+ minimum salary group.

The CPS data presented in Table 22 support the view that access to family planning has spread to women of lower socioeconomic classes in the industrialized Southeast and to a lesser extent in the Northeast. Differences in contraceptive use in the Northeast appear to be related, at least in part, to whether organized family planning programs were operative. These programs appear to have filled the gap in access between lower- and higher-income women, with the latter being able to rely more heavily on private physicians, clinics, and pharmacies.

Further partial information on access is provided by tabulations of CPS survey data on sources of services for two of the main methods, surgical sterilization and oral contraceptives. Table 24 shows that for Sao Paulo, where

TABLE 23 Contraceptive Prevalence Survey Data on Percent of Currently Married Women Aged 15-44 Using Contraceptives, by Education: Brazil

State	Education			
	None	Primary, Incomplete	Primary, Complete	Secondary or More
Piaui	22.3	29.3	44.6	47.0
Pernambuco	27.8	36.6	50.2	60.0
Rio Grande do Norte	37.0	45.2	45.1	61.1
Bahia	16.0	32.9	40.7	59.9

Source: Rodrigues et al. (1981a:Table 6).

organized programs are more limited, 97.5 percent of pill users relied on private physicians; this is also true of Bahia. In Rio Grande do Norte, Pernambuco, and Paraiba, where CBPs had been operative, the BEMFAM-State/Municipal Hospital system provided around 60 percent of services. Table 24 also shows a similar, though less differentiated, pattern for surgical sterilization: again the contribution of private hospitals and clinics is highest in Sao Paulo and Bahia, whereas public-sector sources play a greater role in Rio Grande do Norte, Paraiba, and Pernambuco. One reason that the pattern for sterilization is not as sharply differentiated as that for pills is that sterilization in state/municipal hospitals is not provided through the CBP program. This may be a factor in the lower share of sterilizations among low-income women reported in Table 22. (Sample-size limitations prevented tabulation of the data in Table 24 by source and income level.)

Socioeconomic Factors

Increased use of contraceptives in Brazil during the 1970s was accompanied by a variety of socioeconomic changes, particularly among the regions and income groups responsible for the acceleration in fertility decline. This raises the question of how these two sets of forces may have interacted to bring about that accelerated decline. Important socioeconomic shifts include the

TABLE 24 Source of Family Planning Supplies and Services, Currently Married Women Aged 15-44, CPS Data by State: Brazil

	Sao Paulo 1978	Piaui 1979	Rio Grande do Norte 1980	Paraiba 1980	Pernambuco 1980	Bahia 1980
Oral Contraceptives						
State and municipal hospitals	0.3	35.9	63.2	50.5	59.8	7.6
BEMFAM	0.6					
INPS	1.3	2.4	1.6	0.5	2.6	9.6
Private physician/ clinic/pharmacy	97.5	58.9	33.6	48.0	34.0	81.7
Other	0.3	2.8	1.6	1.0	3.7	1.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Surgical Sterilization						
State and municipal hospitals	23.4	68.1	62.5	49.4	32.9	23.1
INPS	36.0	24.8	23.1	27.2	44.6	42.0
Private hospital/ clinic	34.8	6.2	12.7	22.9	20.5	33.2
Other (incl. not stated)	5.8	0.9	1.6	0.5	1.9	1.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Rodrigues et al. (1981a).

changing status of women, as reflected in their educational attainment and labor force participation, as well as changes in household income and consumption patterns, such as the diffusion of consumer durables like television receivers, refrigerators, and gas stoves among lower-income groups. These changes could have reduced the desire to have more children and increased motivation to use the means of fertility control that were becoming more available.

Data presented in Chapter 2 on differences in the level and percentage of fertility decline by years of schooling revealed significant increases in the educational attainment of women during the 1970s. The data also revealed a close, though not exact, correspondence between the distribution of women by educational attainment and household income deciles (Table 19). In examining socioeconomic changes, the present chapter does not repeat that breakdown by income deciles. Moreover, such a breakdown is not used in the present discussion of the relationship between education and labor force participation. To do so would introduce a circularity arising from the contribution of women's earnings to the income of their households: it would create the misleading impression that the proportion of women who work is higher among households in higher-income deciles, when in fact one of the reasons that such households fall into those higher deciles is because these women work. The relevant income variable is household income without these women's contributions. At this point, the discussion focuses on changes in educational attainment and their relationship to differences in labor force participation.

Table 25 suggests that increases in female educational attainment were greater in the 1970s than in the 1960s. The table shows the proportion reporting no schooling among women aged 20-49 by five-year age groups, in 1960, 1970, 1976, and 1980. For women in their twenties, the proportion with no schooling was around 40 percent in 1960, declining to about 33 percent in 1970, and to below 20 percent by 1976. Increased female school enrollment during the 1960s accounts for part of this increased decline in the proportion with no schooling. Another factor is various types of adult education programs, including adult literacy classes and special courses leading to certification of equivalency at various grade levels. Many employers in the formal sector require such certification, even for semiskilled labor, and these

TABLE 25 Percent of Women Reported as Having No Schooling, by Age, 1960-80: Brazil

Age Group	1960	1970	1976	1980
20-24	39.1	30.6	15.8	16.9
25-29	42.7	35.4	21.7	19.6
30-34	44.4	38.1	24.8	26.9
35-39	52.2	42.5	30.8	
40-44	54.5	45.5	35.4	36.7
45-49	57.0	49.8	39.3	

Source: Population census 1960 and 1980.

courses have helped women to move from informal-sector jobs such as domestic service to formal-sector employment. Data from preliminary tabulations of the 1980 census are also shown. While they confirm the changes that occurred during the 1970s, they also suggest that the 1976 survey may overstate improvements, either through underrepresentation of less-educated women or inconsistency between the survey and census reporting of educational attainment.

Table 26 uses tabulations from the 1970 census and 1976 survey data files to present further detail on the changes that occurred during that interval. For each five-year age group, the percentage of women in each of four educational attainment categories (none, 1-4, 5-9, and 10+ years of schooling) is shown. Again there is a reduction in the percentage of women in the "none" category and increases in other groups. Only a part of this decline represents a "cohort" effect, where succeeding higher-attainment groups replace those with lower attainment. A contributing factor in increases for the 10+ category among women aged 25-29 in 1976 is the fact that some of them were still in school in 1970. Adult education could also account for the changes observed among older women. However, the caution suggested above about the representativeness of the 1976 data and the consistency of reporting in the survey and census sources should be applied to the amount of increase in educational attainment indicated by the table.

TABLE 26 Percent Distribution of All Women Aged 20-44 by Age and Years of Schooling, 1970 and 1976: Brazil

Age Group	Education							
	None		1-4		5-9		10+	
	1970	1976	1970	1976	1970	1976	1970	1976
20-24	30.4	15.6	41.8	39.9	17.3	27.1	10.5	17.5
25-29	35.2	21.2	42.3	42.3	13.9	19.6	8.6	16.9
30-34	38.3	24.2	42.4	47.9	12.9	16.4	6.4	11.5
35-39	42.2	30.1	41.1	47.0	11.9	14.0	4.8	8.9
40-44	45.2	34.4	38.5	45.2	11.9	13.2	4.4	7.2

Note: Each row adds to 100 percent for each year.

Source: Tabulations of census and survey sample data files.

The 1970s also brought increases in female labor force participation. Table 27 presents tabulations of the percentage of women reported as working by age and educational attainment. The education categories are the same as those in Table 26. Rates are shown for all women and for currently married women. In comparing data on labor force participation from the census and survey, it is important to recognize that the two sources define participation differently: in the census, a person was considered active if market work was his or her principal activity during the year prior to the interview; in the survey, a person who worked during the week prior to the interview was considered active. The census definition tends to understate economic activity for those employed part-time or on an intermittent basis, generally younger and older people and women more than middle-aged males (for further discussion of this point see Merrick and Graham, 1979:167). This could lead in turn to an overstatement of increases in labor force participation for such groups when the census and survey data are compared.

Data for all women in Table 27 indicate that in 1970, women with higher educational attainment (10+ years of schooling) were three to four times as likely to be working as women with no education. Increases in labor force participation among women in lower educational attainment categories narrowed this differential to a

TABLE 27 Percent of Women Reported as Working, by Age and Years of Schooling, 1970 and 1976: Brazil

Age Group	Education: None 1970	None 1976	1-4 1970	1-4 1976	5-9 1970	5-9 1976	10+ 1970	10+ 1976
All Women								
20-24	18.0	29.2	26.4	35.5	35.1	40.5	52.9	55.5
25-29	14.8	24.8	19.4	28.9	30.7	36.9	66.3	63.3
30-34	14.6	28.1	17.7	28.3	29.7	34.9	66.0	65.4
35-39	15.3	28.9	18.7	29.5	30.0	37.2	66.8	67.8
40-44	16.4	28.5	18.3	27.6	28.6	33.9	66.5	64.8
Currently Married Women								
20-24	5.7	12.2	6.3	13.0	13.4	16.6	39.9	38.5
25-29	6.2	15.0	8.0	17.2	15.5	21.9	54.1	47.5
30-34	6.9	20.5	9.7	20.2	18.0	24.0	56.4	55.0
35-39	8.2	21.6	11.3	22.7	21.0	29.3	58.9	59.5
40-44	7.8	20.9	11.0	21.5	19.5	26.2	56.1	56.4

Source: Tabulations of census and survey data files.

little more than two times in 1976. Percentage point increases in both the "none" and 1-4 education categories were greater for women over age 30. For women in the 10+ educational attainment category, the percent reported as active declined in three of the five age groups.

These increases in labor force participation among less-educated women, particularly those over age 30, show up even more strongly in rates for currently married women, as shown in the second panel of Table 27. In 1970, only 7-8 percent of married women over age 30 in the "none" education group were working; in 1976, this proportion increased to over 20 percent. Similar increases can be observed in the 1-4 year education group, though there was less change for women over 30 because they started from a slightly higher base in 1970. In the 10+ education group, rates declined for the first three age groups and increased only slightly for the other two. As a consequence, the magnitude of differentials in participation rates between women with no

education and those with 10+ years of schooling decreased from 7 or 8 to 1-2 or 3-1.

Increased educational attainment, higher labor force participation among more-educated women, and the narrowing of differentials in participation between more- and less-educated women between 1970 and 1976 combined to double the proportion (from 15 percent to 30 percent) of women who were working during the six-year period under study. Although caution is required because of possible upward bias in the 1976 data resulting from definitional differences mentioned above, the data suggest that important changes in women's roles were occurring. Increases in labor force participation, associated with increases in the proportion of women with higher levels of education, suggest an improvement in these women's status; on the other hand, these trends among women in the lower education classes may mean that more women were working out of economic necessity.

SOCIOECONOMIC FACTORS AND FERTILITY DECLINE AMONG URBAN AND RURAL WOMEN

While the hypotheses about relationships between socioeconomic factors (modernization, increased economic pressures on families) and fertility decline in Brazil outlined above are broadly applicable to both urban and rural women, differences in institutional factors suggest that these groups be examined separately. For example, increased ownership of televisions, while not exclusively an urban phenomenon, is much more pronounced in urban areas. Likewise, the influence of land availability and increased proletarianization of farm labor is probably more direct in rural areas. While indirect effects could reach urban areas via migration, they are much more difficult to capture with the census and PNAD survey data files. Based on separate samples for urban and rural women extracted from these files, the next two subsections present a more detailed examination of the characteristics of currently married urban and rural women, and how these characteristics relate to differentials in average parity. The focus in both subsections is restricted to currently married women because the analysis of proximate determinants of fertility presented in Chapter 1 identified declining marital fertility as the main component of the recent decline in Brazilian birth rates.

Currently Married Urban Women

Data presented in Chapter 2 on levels and changes in fertility rates by socioeconoic class revealed that major differentials were associated with female educational attainment. To see how these differentials are reflected in the average parity of currently married urban women, and to permit further comparisons by other characteristics of these women, subsamples of about 17,000 women each were extracted from the census and survey data files. (Cost considerations dictated the decision to use subsamples.) Table 28 presents tabulations of the mean number of children ever born to currently married urban women in 1970 and 1976 by age and educational attainment. Standard errors of means for the age/education breakdowns of the two subsamples are also shown. While most cells

TABLE 28 Mean and Standard Error (S)[a] of Number of Children Ever Born, Currently Married Urban Women, by Age and Educational Attainment, 1970 and 1976: Brazil

	Education							
	None		1-4		5-9		10+	
Age Group	Mean	(s)	Mean	(s)	Mean	(s)	Mean	(s)
1970								
20-24	2.51	(.08)	1.79	(.04)	1.43	(.05)	0.70	(.06)
25-29	3.91	(.09)	3.07	(.05)	2.39	(.06)	1.50	(.06)
30-34	5.04	(.10)	4.08	(.06)	3.20	(.08)	2.30	(.07)
35-39	6.16	(.12)	4.75	(.08)	3.82	(.10)	3.12	(.11)
40-44	6.64	(.15)	5.11	(.10)	3.75	(.12)	3.20	(.16)
N (unweighted)		4,059		8,081		3,252		1,396
Percent (weighted)		24.2		48.1		19.4		8.3
1976								
20-24	2.07	(.08)	1.72	(.04)	1.23	(.03)	0.69	(.04)
25-29	3.65	(.10)	2.69	(.04)	1.99	(.04)	1.30	(.04)
30-34	4.86	(.12)	3.70	(.05)	2.99	(.07)	2.03	(.05)
35-39	6.26	(.14)	4.57	(.07)	3.44	(.08)	2.68	(.08)
40-44	6.47	(.16)	5.00	(.08)	3.58	(.11)	2.78	(.10)
N (unweighted)		2,632		8,019		4,205		2,828
Percent (weighted)		16.0		47.9		22.1		14.0

[a](s) is standard error of sample means.

Source: Tabulations of subsamples of census and survey data files.

are large enough at this level to minimize sampling error, further breakdowns could be affected, particularly when a small percentage of women fall into a given category. Further tests of the significance of educational and other differences in the number of children ever born are presented in the next chapter using multiple regression.

The basic pattern of educational differences in the mean number of children ever born is similar in 1970 and 1976: comparing women in the age 40-44 category, the mean number of children ever born in 1970 drops from 6.6 children for women with no education to 3.2 children for those with 10+ years of schooling; in 1976, the figures are 6.5 children for women with no education and 2.8 for those with 10+ years of schooling. The earlier average age at marriage of women with no education is a major factor in differences among younger women, who had 2.5 births in 1970 compared to 0.7 for the 10+ group, and 2.1 compared to the 10+ group's 0.7 in 1976. The values for older women with 10+ years of school are a problem in that the average of 2.8 for women aged 40-44 in 1976 is lower than the 3.1 reported for those aged 35-39 in 1970. Sampling error is the most likely culprit, since the .95 confidence intervals of the standard errors of the two means intersect. Shifts of women from the 5-9 class in 1970 to the 10+ class in 1976 could not account for this since they would bias the 1976 figure upward rather than downward.

How do other characteristics such as work status and migrant status affect fertility differentials? The generalizations in the previous section about increases in educational attainment and labor force participation hold for currently married urban women. From 1970 to 1976, the proportion of urban women reporting no education declined from 24.2 percent to 16.0 percent, while that of women with 10+ years of schooling increased from 8.3 to 14.0 percent. Patterns of labor force participation by level of educational attainment are similar to those shown in Table 27, though the differences between education categories are less. The top panel of Table 29 presents participation rates for urban women. Part of the large differential between more- and less-educated women in Table 27 resulted from the lower educational attainment and labor force participation of rural women. For urban women, the order of magnitude of differences between the top and bottom education categories was four to five, narrowing to a range of three to four in 1976. Larger proportional increases among less-educated women over age

TABLE 29 Percent Working and Percent Migrant Among Currently Married, Urban Women, 1970 and 1976: Brazil

Age Group	Education: None 1970	None 1976	1-4 1970	1-4 1976	5-9 1970	5-9 1976	10+ 1970	10+ 1976
Percent Working								
20-24	6.8	8.1	6.1	11.0	12.1	13.1	32.6	37.8
25-29	6.8	12.1	9.2	15.0	15.8	20.6	50.7	46.8
30-34	7.5	15.6	10.2	19.4	17.8	22.7	54.9	54.5
35-39	10.9	19.8	13.5	22.1	21.3	26.5	54.7	57.2
40-44	8.3	16.7	12.5	19.0	19.4	24.0	56.6	55.6
Percent Migrant								
20-24	31.3	31.9	28.0	28.7	31.0	24.1	34.4	30.4
25-29	26.0	24.0	22.1	21.7	17.5	20.5	28.3	25.7
30-34	20.6	17.2	17.0	15.9	15.7	12.8	21.9	16.7
35-39	14.6	10.7	12.1	11.7	11.0	10.7	12.0	13.7
40-44	13.3	12.6	10.5	9.7	8.0	7.1	7.0	12.8

Source: Tabulations of census and survey data files.

30 are observed, but they are not as great as in Table 27. This suggests that definitional differences affecting 1970-76 comparisons may have introduced greater bias in the reporting of work status for rural women.

Another potential source of variation in fertility among urban women is migration, particularly if work status were related to fertility differences and if migrants were more likely to be working than nonmigrants. To assess the possible impact of migration, women were classified by migration status, with those who had resided in their municipality of current residence for less than 6 years being considered migrants. The second panel of Table 29 shows the percentage of currently married urban women who qualified as migrants according to this definition for each of the age and education categories previously identified. The percentages of migrants are greatest for the 20-24 age category and for the lowest and highest education groups. The variation by age is much greater than that across education categories. The limited amount of variation by education raises questions about the link, mentioned above, between

migrant status, work status, and fertility. Tabulations (not shown) of the percentage of currently married women reported as working by age and migration status revealed no differences between migrants and nonmigrants. This suggests that motives for migration other than work--most probably marriage--account for the variation in the proportion of migrants shown in the table.

Returning to the question of increases in female labor force participation and educational attainment, the question of whether these increases indicate changes in women's socioeconomic status can be further clarified by examining the kinds of jobs involved in the increased proportions reporting employment. For this purpose, the occupations of employed women were grouped into four broad status categories: (1) high-status service occupations, including managerial, technical, and professional positions, as well as higher-status jobs in the commercial and financial sectors; (2) low-status service occupations, including domestic and personal services, as well as low-status commercial jobs, counter attendants, waitresses, and clerks; (3) occupations in manufacturing; and (4) others, consisting of nonmanagerial public-sector jobs, any primary-sector jobs held by urban women, and poorly defined occupations.

Table 30 presents the percentage distributions of currently married urban women according to these status categories and their educational attainment. The status distributions also include the proportion of women not working (columns sum to 100 percent), indicating which status categories absorbed employment increases in each educational group between 1970 and 1976. Education can be seen to determine the kinds of jobs women hold: of the 8.2 percent of women in the "none" education category who were working in 1970, 6.8 percentage points (83 percent of workers) were in the low-status service and other categories; of the 50.8 percent working among women in the 10+ education category, 49.3 percentage points (97 percent of workers) were in the high-status service categories. Increases in labor force participation among less-educated women consisted mainly of more jobs in the same category as their 1970 employment. The participation rate of women with no education increased by 6.8 percentage points between 1970 and 1976, with low-status service and other occupations accounting for 90 percent of jobs held by this group. Lower status-jobs also accounted for most of the increases in employment in the middle two education classes, though manufacturing also contributed

TABLE 30 Distribution of Currently Married Women Aged 20-44 by Occupation, Work Status, and Educational Attainment, 1970 and 1976: Brazil

Occupation and Work Status	Education				
	None	1-4	5-9	10+	All
1970					
High Status	0.3	2.0	9.9	49.3	7.1
Manufacturing	1.1	2.8	2.2	0.3	2.1
Low Status	5.1	3.8	3.2	0.3	3.7
Other	1.7	1.8	1.9	0.9	1.7
Not Working	91.8	89.6	82.8	49.2	85.4
Total	100.0	100.0	100.0	100.0	100.0
1976					
High Status	0.8	2.5	10.3	49.4	10.5
Manufacturing	2.3	5.7	5.3	1.0	4.4
Low Status	8.5	7.2	4.8	1.6	6.1
Other	4.4	3.7	2.3	1.1	3.1
Not Working	84.0	80.9	77.3	46.9	75.9
Total	100.0	100.0	100.0	100.0	100.0

Source: Tabulations of census and survey data files.

a small amount. These data suggest that if improvements in women's status occurred through employment, they did so because of increased participation among women in higher educational attainment categories rather than the opening of higher-status jobs to women with lower educational attainment. The fact that increased employment among women with lower or no education consisted mainly of low-status jobs suggests that increased employment for these groups may indicate not so much a return on investment in education, but a desire to maintain or increase household income.

The census and survey data files on which this chapter is based permit only the broadest sort of speculation about changes in household consumption and earning patterns that may be behind these increases in the employment of married women. It was suggested earlier that increased purchases of consumer durables on credit, combined with an inflationary squeeze on household income-generating capacity, may have contributed to increased employment among married women in lower socioeconomic groups. The data files provide information on ownership of a few consumer durables (televisions, gas and electric stoves, refrigerators, and automobiles), but no information on whether the purchase was with cash or credit; however,

given the widespread use of credit and the high cost of most of these items relative to the average monthly earnings of lower-class households, it is likely that most of these purchases were made on credit.

Data on television ownership illustrate the diffusion of consumer durables among lower socioeconomic groups during the early 1970s. Table 31 shows the percentage of currently married urban women residing in households with a television, again broken down by age and educational attainment. Although increases are observed among all of the education groups, the larger proportional increases are concentrated in the two lower groups. Among women aged 25-29, the percent with TVs increased from 12.2 in 1970 to 29.5 in 1976 for the "none" education group, and from 36.0 to 62.7 for the 1-4 group. Similar, though less dramatic, increases were found in the ownership of gas and electric stoves and of refrigerators, though tabulations for those items are not shown. While impressionistic, such evidence supports the view that diffusion of consumer durables among lower-income groups and the resultant increased demands on family budgets may have contributed to the increases in labor force participation observed among women in lower socioeconomic groups.

Did such increases in labor force participation have any influence on fertility? Data on average parity suggest that differences between working and nonworking women were greater in 1970 than in 1976. Table 32

TABLE 31 Percent of Currently Married, Urban Women Living in Households Reporting Ownership of a Television, by Age and Education, 1970 and 1976: Brazil

	Education							
	None		1-4		5-9		10+	
Age Group	1970	1976	1970	1976	1970	1976	1970	1976
20-24	11.8	24.7	29.0	47.6	48.2	67.6	77.1	87.6
25-29	12.2	29.5	36.0	62.7	60.1	80.0	82.9	94.4
30-34	15.8	27.4	41.3	68.6	66.6	84.5	88.7	97.0
35-39	17.2	37.8	45.7	70.5	72.0	86.0	89.9	96.5
40-44	21.3	37.3	51.4	73.7	73.6	91.2	93.3	98.3

Source: Tabulations of census and survey data files.

TABLE 32 Average Number of Children Ever Born for Currently Married, Urban Women, by Age, Education, and Current Employment Status, 1970 and 1976: Brazil

Age Group	Education: None		1-4		5-9		10+		All	
	Currently Employed: No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
1970										
20-24	2.5	2.5	1.8	1.3	1.5	1.1	0.8	0.6	1.8	1.3
25-29	3.9	4.0	3.1	2.6	2.4	2.1	1.7	1.3	3.1	2.2
30-34	5.1	4.0	4.2	3.4	3.3	2.8	2.4	2.2	4.2	3.0
35-39	6.3	5.4	4.8	4.5	3.9	3.6	3.3	3.0	5.0	4.1
40-44	6.7	5.5	5.2	4.2	3.8	3.4	3.6	2.9	5.4	3.9
1976										
20-24	2.0	2.7	1.8	1.4	1.3	0.9	0.8	0.6	1.5	1.0
25-29	3.7	3.5	2.7	2.4	2.1	1.6	1.5	1.1	2.6	1.8
30-34	4.9	4.8	3.8	3.5	3.0	3.1	2.1	2.0	3.6	3.1
35-39	6.3	6.3	4.5	4.2	3.5	3.4	2.7	2.7	4.6	4.0
40-44	6.5	6.3	5.0	5.0	3.6	3.5	3.0	2.6	5.0	4.4

Source: Tabulations of census and survey data files.

presents averages of the number of children ever born for working and nonworking currently married women by their age and educational attainment. In 1970, the average number of children was generally lower for working women. For all education groups combined, the number of children ranges from 1.8 for ages 20-24 to 5.4 for ages 40-44 among nonworking women, compared to 1.3 to 3.9 for working women. The effect of work status varies according to the level of educational attainment and age. For women with no education, average parity is lower for working women after age 30. For women who reported some schooling, the averages are lower for all age categories, with the largest absolute differences (.5 to 1.0 children) occurring in the 1-4 class. In 1976, there is an overall narrowing of differentials between working and nonworking women: there is no difference for women with no education, and the differences for women in the 1-4 group are reduced to less than .4 children per woman; for women with 5-9 and 10+ years of schooling, differences are also reduced. This overall narrowing of differentials raises

the question of whether the relationship between work status and average parity changed between 1970 and 1976, or whether the narrowing reflects changing composition by educational attainment that occurred during this interval. This question is addressed using multivariate regression analysis in the next chapter.

Differences in average parity by migration status, again controlling for age and educational attainment, are shown in Table 33. Age and education influence the direction of differences by migrant status. Overall, there are no differences between migrant and nonmigrant women under age 35, but higher averages for migrant women in the 35-39 and 40-44 age groups. When the data are broken down by education, younger nonmigrant women have higher average parity in the "none" education and 1-4 years of schooling categories. A shift to higher averages for migrant women in the two upper age groups also occurs in these categories. There are no differences between migrants and nonmigrants in the 5-9 education group, but higher averages show up again for three of the four cells

TABLE 33 Average Number of Children Ever Born for Migrant and Nonmigrant Women, by Age and Educational Attainment, 1970 and 1976: Brazil

	Education									
	None		1-4		5-9		10+		All	
	Migrant									
Age Group	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
1970										
20-24	2.7	2.2	1.8	1.7	1.4	1.4	0.7	0.7	1.8	1.7
25-29	4.0	3.6	3.1	3.1	2.4	2.4	1.5	1.4	3.0	2.9
30-34	5.1	4.9	4.0	4.3	3.2	3.2	2.3	2.1	4.0	4.1
35-39	6.2	6.1	4.7	5.3	3.8	3.7	3.1	3.4	4.8	5.2
40-44	6.6	6.9	5.0	5.8	3.8	3.6	3.2	3.8	5.1	5.8
1976										
20-24	2.1	1.9	1.8	1.6	1.2	1.2	0.7	0.6	1.5	1.4
25-29	3.6	3.7	2.7	2.6	2.1	1.6	1.3	1.2	2.4	2.2
30-34	4.9	4.7	3.7	3.5	3.0	2.9	2.1	1.7	3.5	3.3
35-39	6.2	7.3	4.4	4.6	3.5	3.3	2.6	3.1	4.4	4.6
40-44	6.3	7.7	4.9	6.5	3.6	3.8	2.8	2.8	4.7	6.1

Source: Tabulations of census and survey data files.

containing older migrant women in the 10+ education category. The higher average parity among older migrant women probably reflects the fact that these women made recent moves as members of a family unit, whereas a large share of the moves of recent younger migrants may have been associated with or occurred before marriage; this could explain why nonmigrants with lower educational attainment had higher average parity.

The data on links between selected measures of the socioeconomic status of currently married urban women and differentials in their average parity raise several issues for further analysis. After controlling for age, the greatest differentials in average parity are those associated with educational attainment, with significantly lower levels of average parity being observed among women with higher levels of education. Since there were important shifts of women to higher education categories between 1970 and 1976, increased education stands out as a key factor among the socioeconomic variables associated with fertility declines during that interval. However, the question remains of whether the impact of education was mainly a change in the distribution of women by educational attainment, or whether and how education may have interacted with other variables, perhaps with changes in its relationship to fertility differentials resulting from changes in those variables. For example, average parity was lower among working than nonworking women, but the nature of this relationship was conditioned by education. Work status itself was closely associated with educational attainment, with a greater proportion of working women among those with higher education. However, increases in the percentage of women working between 1970 and 1976 were greatest for those in lower educational categories. One effect of this was a narrowing of the differential in average parity between working and nonworking women between 1970 and 1976. This suggests that something beyond changes in educational composition may have been at work, perhaps along the lines of the argument suggested earlier about increased work to maintain household income or to finance increased consumption of consumer durables. Though the census and survey files provide little supporting evidence for this idea, the data on increased ownership of televisions among less-educated women support such a view. Although the links between migrant status and differences in average parity are less clear, those that do appear were conditioned by education and age.

Currently Married Rural Women

For currently married rural women, differences in average parity may reflect not only variation in individual and household characteristics, but also institutional factors such as availability of and access to land, land tenure, and differences in modes of agricultural production. Again, Brazil's regional diversity is important. Traditionally, high rural fertility in Brazil suggests that children have been an important asset to rural families; research on subsistence farmers in the Northeast has revealed that even very young children contribute to household production (Almeida, 1977).

A number of hypotheses have been suggested about the effects of recent socioeconomic changes in Brazil on rural fertility differences. One is that increased scarcity of land in more settled areas has reduced the value of children as farm laborers and made it more difficult for children to acquire a farm through inheritance. Research based on data from the 1970 population and agricultural censuses indicated that fertility was lower in more settled regions of Southeastern Brazil and higher on the agricultural frontier. However, the link between fertility and land availability was also conditioned by institutional factors, particularly Brazil's unequal distribution of land (Merrick, 1978); rural fertility in Northeastern Brazil was much less responsive to land scarcity as a consequence (Merrick, 1981).

Paiva (1982) has argued that the proletarianization of rural labor (the shift of farm labor out of smallholder status into wage labor as a result of the consolidation of land into larger holdings) has contributed to Brazil's recent fertility decline. He suggests that the effects of proletarianization in Brazil differ from the European experience described by Tilly (1978) and others, where fertility increased because the formation of new farm families was linked to having a plot of land.

These hypotheses will be discussed further in Chapter 4. The remainder of the present chapter explores differences in the average parity of currently married rural women in Brazil, using cross-tabulations that control for age and other socioeconomic variables. Subsamples for rural women were extracted from the 1970 census and 1976 survey data files. Since the 1976 survey did not include rural areas in the Northern and Central-Western regions of Brazil, the data on rural women are restricted to the Northeastern, Southeastern, and Southern states. Regional

breakdowns follow the grouping adopted in Chapter 2, with the first consisting of the Northeast, the second including the states of Rio de Janeiro and Sao Paulo (labeled RJ-SP), and the remaining states (Minas Gerais, Espirito Santo, Parana, Santa Catarina, and Rio Grande do Sul) constituting a third group labeled "other." In Chapter 2, unadjusted total fertility rates for rural areas of these three groups of states showed that while fertility was lowest in Rio and Sao Paulo in 1970, fertility decline between 1970 and 1976 was most rapid in the "other" group, which fell between RJ-SP and the Northeast in level of socioeconomic development.

The same pattern appears when average parity is broken down by region, with controls for age and education. Table 34 presents data on the mean number of children ever born for currently married rural women in the three regional groups, with women grouped according to whether they had no education or reported any years of schooling completed. Average parity in 1970 was uniformly higher in the Northeast, with no apparent difference between those with none and those with some education. In 1970, the latter category accounted for only 26 percent of women in the region; this proportion increased to 39 percent in 1976, at which time differences by educational attainment also became observable. For example, there was only 0.1 difference for women aged 25-29 in 1970, but a .8 difference in 1976. In the other two regions, half of the women reported having some education in 1970, with the proportion rising to 65 percent in RJ-SP and 67 percent in the "other" group in 1976. In 1970, average parity was lower for rural women with some education in both regions, and this differential widened in 1976: for women aged 25-29, the differential was .4 in 1970 for the "other" group, increasing to 1.0 in 1976; for RJ-SP, it increased from .8 to 1.0. This indicates a more rapid fertility decline in the former region, which is consistent with the findings reported in Chapter 2.

To what extent does variation in other socioeconomic characteristics of rural women relate to differences in average parity? Table 35 presents the percentages of currently married rural women according to three characteristics; two of these (work status and migration status) were also examined for urban women, while the third (proletarianization) was defined to explore the hypothesis that shifts of the rural population into wage labor contributed to recent fertility declines. To measure proletarianization, women were grouped according to whether

TABLE 34 Mean Number of Children Ever Born for Currently Married, Rural Women by Region, Educational Attainment, and Age, 1970 and 1976: Brazil

Age Group	Education					
	Northeast		RJ-SP		Other	
	None	Some	None	Some	None	Some
1970						
20-24	2.48	2.28	2.18	1.84	2.36	1.85
	(.06)	(.09)	(.16)	(.09)	(.07)	(.06)
25-29	3.91	3.79	4.08	3.26	3.83	3.38
	(.08)	(.13)	(.20)	(.14)	(.09)	(.07)
30-34	5.72	5.57	5.04	4.25	5.40	4.69
	(.12)	(.16)	(.22)	(.18)	(.12)	(.10)
35-39	6.86	6.79	6.47	5.31	6.51	5.99
	(.13)	(.23)	(.26)	(.26)	(.13)	(.15)
40-44	7.46	8.25	6.77	6.01	6.89	6.62
	(.17)	(.32)	(.30)	(.35)	(.16)	(.17)
N (unweighted)	4,111	1,435	741	742	2,939	2,939
Percent (weighted)[a]	74.1	25.9	50.3	49.7	50.0	50.0
1976						
20-24	2.46	1.97	2.18	1.67	2.27	1.59
	(.08)	(.08)	(.14)	(.05)	(.09)	(.04)
25-29	4.12	3.29	3.80	2.83	3.78	2.78
	(.09)	(.10)	(.16)	(.08)	(.10)	(.06)
30-34	5.77	5.49	5.00	4.03	5.11	4.19
	(.12)	(.14)	(.21)	(.12)	(.14)	(.08)
35-39	7.13	7.07	6.03	4.64	6.51	5.43
	(.14)	(.19)	(.23)	(.14)	(.14)	(.11)
40-44	8.41	7.25	6.74	5.56	6.98	6.16
	(.18)	(.25)	(.21)	(.22)	(.17)	(.14)
N (unweighted)	3,143	1,987	823	1,916	1,913	3,572
Percent (weighted)[a]	61.3	38.7	35.1	64.9	33.3	66.7

Note: Standard errors of means in parentheses.

[a]Percentages refer to distribution within each region.

Source: Tabulations of subsamples of census and survey data files.

TABLE 35 Percent of Currently Married, Rural Women in Proletarian Households, Percent Working, and Percent Migrant, by Age and Region, 1970 and 1976: Brazil

Age Group and Status	Region					
	Northeast		RJ-SP		Other	
	1970	1976	1970	1976	1970	1976
Working						
20-24	6.5	15.2	2.8	6.9	5.7	19.8
25-29	9.2	16.6	4.8	15.4	6.6	22.8
30-34	8.9	24.0	3.2	13.2	6.6	26.9
35-39	8.0	24.0	5.0	20.6	5.6	28.5
40-44	9.2	26.4	3.8	19.3	7.5	27.5
Migrants						
20-24	8.6	11.3	23.7	32.3	22.7	21.5
25-29	8.8	10.9	22.0	25.2	19.5	16.7
30-34	6.9	8.6	20.5	25.2	17.9	17.4
35-39	6.2	5.1	14.6	16.1	14.7	13.1
40-44	6.7	5.9	18.0	14.9	13.2	10.3
Proletarian						
20-24	25.0	38.9	64.8	81.0	25.7	46.1
25-29	25.4	37.1	58.6	74.1	26.1	41.6
30-34	23.9	36.0	53.0	67.3	22.8	37.7
35-39	21.3	31.7	51.1	60.5	24.8	38.9
40-44	20.6	31.1	48.8	66.0	21.3	32.4

Source: Tabulations of subsamples of census and survey data files.

the head of the household in which they resided was a wage laborer or not, with the former considered proletarian. Migrant status and work status were defined as they were for urban women: women who had resided in their present municipality for 5 years or less were considered migrants, and work status was established according to the census and survey data. The earlier caution about differences in the way these sources define labor force participation is particularly important here, since a higher proportion of rural than urban women fall into the grey area defined by the census as not working and by the survey as working.

The proportion of rural women reported as working was below 10 percent for all of the age groups in all of the regions in 1970, ranging from 3 to 5 percent in Rio and Sao Paulo to 6 to 9 percent in the other two regions. When these figures are compared to the 1976 data, substantial increases are indicated. While it is impossible to tell how much these increases represent definitional differences, it does appear that increases may have been greater for women over age 30. It is also difficult to judge whether the lower rates in RJ-SP represent true differences in work status or some sort of regional variation in reporting.

In the case of migration, the highest proportion of women reported as migrants in both 1970 and 1976 is found in Rio and Sao Paulo, and the lowest in the Northeast. There is a slight increase in the migrant proportion in both regions between 1970 and 1976. As would be expected, migration rates are higher among women in their twenties than among those in their thirties. Rates in the "other" region are somewhat lower than those in the RJ-SP in 1970, but drop slightly between 1970 and 1976.

Regional differentials in socioeconomic characteristics are greatest in the proportion of women in proletarian households. In 1970, the shift to wage labor among household heads had progressed furthest in Rio and Sao Paulo, with the highest proportions being reported for younger women; these figures ranged from 65 percent for women aged 20-24 to 49 percent for those aged 40-44. The proportions were about equal in 1970 in the other two regions, ranging from 20 to 26 percent. Between 1970 and 1976, the greatest percentage point increases in proletarianization occurred in the "other" region, though the highest level of proletarianization continued to be that of RJ-SP. In the latter, the percentage ranged from 81 percent for women aged 20-24 to 66 percent for those 40-44, compared to 46 and 32 percent, respectively, in the former. This suggests that proletarianization may have been a factor in the lower fertility observed in Rio and Sao Paulo in 1970, as well as in the more rapid fertility decline observed in the "other" region between 1970 and 1976.

To what extent are these differences in socioeconomic characteristics reflected in average parity? Table 36 presents the mean number of children ever born by age and region for women in proletarian and nonproletarian households. Neither 1970 nor 1976 results suggest that average parity is significantly lower among the former group. Indeed, their averages are more often higher than lower;

TABLE 36 Mean Number of Children Ever Born for Currently Married, Rural Women Aged 20-44, by Region and Proletarian Status, 1970 and 1976: Brazil

Age Group	Region					
	Northeast		RJ-SP		Other	
	Proletarian					
	No	Yes	No	Yes	No	Yes
1970						
20-24	2.4	2.6	1.8	2.1	2.1	2.0
25-29	3.8	4.0	3.4	3.7	3.6	3.6
30-34	5.6	6.0	4.5	4.7	5.1	4.8
35-39	6.8	7.0	5.8	6.6	6.3	6.2
40-44	7.6	7.7	6.5	6.6	6.8	6.8
1976						
20-24	2.2	2.3	1.8	1.7	1.8	1.8
25-29	3.8	3.8	2.8	3.2	3.0	3.2
30-34	5.6	5.8	4.0	4.5	4.4	4.7
35-39	6.9	7.5	5.0	5.3	5.6	6.0
40-44	8.0	8.3	5.5	6.5	6.5	6.5

Source: Tabulations of census and survey data files.

they are consistently higher in RJ-SP, where the proportion of proletarian women in the total is highest. This is puzzling in view of the relationship between fertility levels and the level of proletarianization at the regional level. It suggests that the effect of proletarianization on fertility may operate through a complex of other variables whose effects are manifested in such regional differences, or that proletarianization itself may be a manifestation of changes in another variable or set of variables.

One such important variable may be work status. Table 37 presents average parity for working and nonworking women by age and region. The table suggests that average parity was slightly lower for working women in the Northeast and "other" regions in 1970, but not in Rio de Janeiro and Sao Paulo; there were so few working women in the latter two states in 1970 that none of the averages for that group were significantly different from those of nonworking women. In 1976, the pattern of differences between working and nonworking women was even less clear: there were still no differences in RJ-SP, while working

TABLE 37 Mean Number of Children Ever Born for Currently Married, Rural Women Aged 20-44, by Region and Work Status, 1970 and 1976: Brazil

	Region					
	Northeast		RJ-SP		Other	
	Working					
Age Group	No	Yes	No	Yes	No	Yes
1970						
20-24	2.4	2.5	2.0	1.6	2.1	1.9
25-29	3.9	3.4	3.6	4.1	3.6	3.3
30-34	5.7	5.5	4.7	3.0	5.1	4.3
35-39	6.9	6.1	6.0	5.1	6.3	5.5
40-44	7.6	7.4	6.5	7.9	6.9	5.8
1976						
20-24	2.3	2.0	1.8	1.9	1.8	1.7
25-29	3.9	3.3	3.1	2.8	3.2	2.9
30-34	5.6	5.9	4.3	4.6	4.4	4.6
35-39	7.2	6.8	5.2	5.1	6.0	5.3
40-44	8.2	7.8	6.2	6.1	6.6	6.4

Source: Tabulations of census and survey data files.

women showed slightly lower averages for all but the age 30-34 group in the other two regions. The lack of any difference in the RJ-SP group and the reduction in the "other" group between 1970 and 1976 suggest that the effect of work status on fertility differences is reduced as proletarianization increases. Another potential covariate is migration; however, tabulations of average parity by migration status revealed no significant differences, and the results are not presented here.

This leads us back to education, which was the only socioeconomic characteristic of rural women for which a consistent and statistically significant pattern of differences in average parity was observed. It is tempting to conclude that education accounts for most of the differentials, as well as the changes in rural fertility observed between 1970 and 1976. A problem with the second point is that levels of educational attainment increased almost equally during that period in the RJ-SP and "other" regions, yet fertility decline was more rapid in the latter. Either the evidence is only circumstantial that relative increases in proletarianization in that region were also greater, or there may have been interaction between the education and proletarianization variables, and others as well. Since further presentation of data in tabular form would be an awkward way to address this issue, that task is undertaken in the next chapter using multiple regressions.

CONCLUSIONS

The purpose of this chapter was to examine evidence on the spread of contraceptive use to women in lower and middle socioeconomic classes who accounted for much of the acceleration in the decline of Brazilian marital fertility in the early 1970s, focusing on changes in the socioeconomic characteristics of these women that could have increased their motivation to control fertility. Because there are no nationally representative data on contraceptive use or socioeconomic characteristics, data on contraceptive use from recent state-level surveys were pieced together, while changes in socioeconomic variables and their relation to differences in average parity were examined based on 1970 census and 1976 PNAD survey data files.

Analysis of the proximate determinants of fertility in Chapter 1 identified increased use of contraception (or

contraception combined with abortion) as a key factor in Brazil's accelerated fertility decline in the 1970s. Baseline data that would permit measurement of the extent to which this increase represented the spread of fertility control among lower- and middle-income groups are lacking; however, data from contraceptive surveys taken later in the decade show significant percentages of contraceptive use among these groups. This, along with evidence in Chapter 2 showing that these groups experienced the most rapid fertility decline during the decade, supports the conclusion that their use of fertility control had indeed increased. While Contraceptive Prevalence Surveys show that differences in contraceptive use between higher and lower income and education groups remained, the percentage of use among the latter was far from negligible. Survey data also show that organized family planning programs contributed to a reduction in socioeconomic class differentials in contraceptive use in a number of Northeastern states.

This occurred during a period when significant changes in socioeconomic conditions affecting the status of women were taking place in Brazil. The proportion of women reporting no education was reduced, and there were significant increases in the proportion reporting higher levels of educational attainment in both urban and rural areas. Increased proportions of married women were also reported as working, though it is difficult to determine to what extent this reflects differences in the way census and survey data defined labor force participation. Increased ownership of consumer durables was observed among women in urban households, while rural households were becoming increasingly reliant on wage labor, or proletarianized.

Such changes are consistent with a number of hypotheses about the reasons for increased motivation to control fertility. Increases in educational attainment represent a powerful modernizing force, and the relationship between differences in average parity and education noted in this chapter is clearly very strong. However, this relationship was complicated by significant collateral changes relating to increased economic pressures on low-income urban households and increases in rural proletarianization. The multivariate regression analysis in the next chapter permits further examination of hypotheses linking differences in average parity to these variables, as well as a decomposition of changes in average parity from 1970 to 1976 as they relate to changes in population composition and in the impact of the different variables on fertility.

CHAPTER 4

ANALYSIS OF FERTILITY DETERMINANTS AT THE NATIONAL LEVEL

This chapter uses multivariate regression analysis to explain how changes in average parity among married women in Brazil relate to their changing socioeconomic characteristics during the accelerated fertility decline of the early 1970s. In so doing, it attempts to provide a more systematic assessment of the hypotheses presented in the last two chapters, supported by tabular evidence, about socioeconomic differences in fertility decline in Brazil and the forces behind those differences.

The decision to focus on variability in the average parity of married women was based on several considerations. First, fertility was measured according to average parity rather than the last birth reported because of the questionable reliability and comparability of the latter in studying changes over time among different socioeconomic groups. Second, analysis of the proximate determinants of the decline in the total fertility rate between 1970 and 1976 indicated fertility control by married women to be the major factor involved; this conclusion was also supported by evidence on the diffusion of contraception among new regions and income groups. Third, accelerated fertility decline coincided with a number of important socioeconomic changes that could have had an impact on the motivation to control fertility, including increases in female educational attainment and possible aggravation of inflationary pressures on the economic resources of low- and middle-income households. The last two points suggested a working hypothesis about the acceleration of fertility decline: that it was triggered by the convergence of two sets of forces--increased availability of effective means of contraception and the emergence of socioeconomic conditions conducive to smaller family norms.

Because there is a lack of nationally representative data combining information on contraceptive use and socioeconomic characteristics, the analysis in this chapter is limited to the second set of forces. The principal question addressed is the extent to which the effects on reproductive behavior of such modernizing forces as increased household income and female educational attainment (as measured by average parity) combined with other factors affecting household behavior, particularly those reflecting such major structural dimensions of the Brazilian economy as inflation and income distribution. Differential patterns of change among rural and urban areas suggested a division of the chapter into separate sections for these groups, though work on the latter was even more restricted by data limitations.

URBAN WOMEN

As noted earlier, the acceleration of fertility decline in Brazil coincided with a period during which lower- and middle-income urban households were raising their consumption expectations and beginning to realize them through increased purchases of housing and other consumer durables, including televisions and automobiles, with most purchases made on the installment plan. Unequal treatment of wages and credit obligations in Brazil's indexing system made it more difficult for families to keep up with payments, and even to purchase basic necessities during periods of high inflation. As was suggested earlier, this, combined with increased knowledge of and access to contraception, may have reduced family-size desires. This explanation does not compete with a modernization framework, but extends it to incorporate other structural changes.

Among the research questions that need to be addressed are the following: (1) What measures in the available data files can be used as appropriate indices of the modernizing forces and economic pressures discussed above? (2) How should the relationship between these measures and average parity be specified? Are the relationships linear? Should interactions be taken into account? (3) Can the analysis be pushed beyond explanation of differentials in average parity in 1970 and 1976 to an assessment of the sources of change in fertility during that interval? In other words, do declines in average parity reflect changes in the composition of the population of married women

according to modernizing characteristics, or is it more a case of changes in the parameters that reflect the impact of these variables on parity? The latter are likely to reflect structural changes, and one of the tasks here will be to incorporate in the specification variables for which such changes would be indicative of the specific structural forces hypothesized above, that is, increased economic pressures on household resources.

It is important to recognize that questions in censuses and large-scale surveys do not provide a great deal of conceptual precision for the measurement of modernization and its influence on fertility. Most of the measures in this chapter have appeared in the presentation of tabular evidence in earlier chapters; these include income and education, as well as age. A new variable that attempts to measure households' relative economic positions has also been added.

Table 38 lists the variables that have been selected for the analysis of data on urban women. Variable labels and a summary of variable definitions are shown. Average parity (CEB), the dependent variable, is listed first. In accounting for variation in this variable, the amount of exposure to the risk of conception needs to be controlled. This risk is associated with marital duration and maternal age. Data on age at marriage are provided only in the 1976 data file; maternal age is a less satisfactory substitute, particularly at earlier ages when there is greater variability because the marriage is recent. To maintain comparability between 1970 and 1976, regressions were run using maternal age (AGE) as a control for exposure to risk. Women were first separated into three broad age categories, with AGE used as a control variable for each: (1) 20-24, (2) 25-34, and (3) 35-44. To test the sensitivity of results to marital duration (MDUR), the 1976 data were then run using the AGE control variable.

The next two variables on the list relate to modernization. It has become fairly standard practice in analytical approaches influenced by household economic theory to use women's average educational attainment (MED) and their own and their husband's earnings (HINC) as variables in analyzing differences in average parity (see Schultz, 1976). Women's earnings and educational attainment reflect the opportunity costs of childrearing vis-a-vis other uses of their time, while the earnings of husbands and wives measure their available resources for childrearing and other activities. Theoretically, the effect

TABLE 38 Variable Labels and Definitions, Urban Women: Brazil

Variable	Definition
CEB	Average parity: number of live children ever born as reported in 1970 census and 1976 PNAD survey.
AGE	Mother's age: in years.
MED	Mother's education: natural logarithm of the number of years of school completed, defined as follows: MED=log (years +1), so that log (0 years)=0.
HINC	Monthly earnings of the head of household: natural logarithm of amount in 1970 cruzeiros.
MDUR	Duration of marriage in number of years for currently married women.
GAP	Estimated log of head's monthly earning (PINC) minus log of observed earnings (HINC).
	PINC = p(HED, EXP, TAX), where:
	HED = years of school completed by head.
	EXP = head's age - years of school completed - 6.
	TAX = natural logarithm of value added tax per capita of state in which woman resides.

on the number of children should be negative for cost factors and positive for resource factors; in fact, however, both often turn out to be negative because increasing income is usually accompanied by changing attitudes about family size, including a preference for quality rather than quantity of children.

Tabular evidence in earlier chapters indicated that differences in average parity in Brazil negatively correlated with both income and education. However, the question was raised of whether parity changes between 1970 and 1976 mainly reflected changes in the educational and income levels of married women of reproductive age, or whether other variables related to inflation and income distribution also contributed to fertility decline. The available census and survey data files provide only a few threads of evidence on the latter. Increased ownership of televisions, particularly among low-income households

likely to have purchased them on credit, suggests that such factors could have been operative; increased female labor force participation suggests that economic pressures might have contributed to the delay or termination of childbearing.

However, exploratory attempts to incorporate television ownership and female labor force participation in the specification of the relationship between female educational attainment, husband's earnings, and average parity yielded unsatisfactory results. The problem was in identifying the endogenous effects of the employment and earnings of women in reproductive ages on their fertility, vis-a-vis the exogenous influence of those women's education and their husbands' earnings. The data files did not provide other exogenous variables that could be used to estimate fully identified parameters for female employment and earnings. Consequently, the analysis was limited to estimation of reduced-form coefficients; that is, only exogenous variables were included on the right-hand side of the regression equation.

In view of this, and to permit continued pursuit of a specification that would capture the effect of the relative economic position of a woman's household (as well as possible changes in that position) on her fertility, an approach based on the concept of relative income was adopted. A household's income is relative in that it may be greater or less than the income stream that would be expected on the basis of that household's human capital endowments. A gap between observed and expected income, if it existed, would indicate whether a household was more or less vulnerable to outside economic pressures such as inflation. The approach is consistent with Leibenstein's (1974) point about the relationship between income and fertility: that while the overall relationship may be negative, it may be positive within specific reference groups, with higher fertility among higher-income households within a particular group.

This approach was operationalized by first estimating the expected earnings of husbands using standard earnings equations, and then determining what each husband's earnings would be given his particular characteristics. The estimates were based on husband's earnings rather than household income for simplicity's sake (estimates could then be based on the characteristics of one individual without consideration of household size and structure as well as other income sources). Some of the limitations of this approach are offset by the fact that the analysis

was restricted to married women with husbands present who were living in single-family households.

Earnings are measured in logarithms of 1970 Cruzeiros per month. The difference between reported (HINC) and estimated (PINC) earnings provides a measure of the gap described above. Variables in the earnings equation include husband's education in years of schooling completed (HED); husband's experience (current age minus years of schooling minus six [EXP]); and an index of the level of industrial output in the state of residence, which consists of the amount of value-added tax on manufacturing per capita in the state (TAX). The latter variable was added as a control for regional differences in labor market conditions, which are known to vary widely in Brazil. Earnings equations were estimated for 1970 and 1976, with the following results:

1970: PINC = 3.837 + .149 HEDUC
(85.3) (74.5)
+ .0008 EXP + .249 TAX
(1.1) (31.1) R2 = .38

1976: PINC = 4.013 + .158 HEDUC
(77.2) (79.0)
+ .011 EXP + .232 TAX
(10.9) (25.8) R2 = .37

Values of the t-statistic are shown in parentheses beneath regression coefficients. A new variable (GAP) was defined as the difference between PINC and HINC.

Other variables omitted from the analysis of individual-level data studied in this chapter were infant and child mortality. Mortality measures for use in analysis of individual records can and have been derived from these data files (Merrick, 1981); however, the process of transforming ratios of surviving children to children ever born into a normally distributed, jointly dependent variable would require controlling these ratios for length of exposure to risk of mortality using parity progression ratios. It was impossible to specify a statistically meaningful causal relation between fertility and mortality in such circumstances.

Unweighted means and standard deviations of the variables used in the regression analysis of differences in average parity are presented in Table 39. The data are broken down according to the three broad age categories described above. Exploratory analysis of the relationship between MED and CEB suggested a nonlinear specification.

TABLE 39 Means[a] (standard deviations) of Variables Used in Analysis of Differences in Average Parity for Urban Women, 1970 and 1976: Brazil

Year and Variable	Age 20-24	25-34	35-44
1970			
CEB	1.78	3.47	5.00
	(1.51)	(2.43)	(3.51)
MED	1.31	1.29	1.17
	(0.79)	(0.83)	(0.84)
AGE	22.19	29.52	39.17
	(1.37)	(2.85)	(2.84)
HINC	5.60	5.76	5.75
	(0.92)	(1.06)	(1.21)
GAP	0.11	-0.01	-0.04
	(0.72)	(0.81)	(0.97)
N	2,749	7,532	6,494
1976			
CEB	1.45	2.89	4.61
	(1.21)	(2.07)	(3.11)
MED	1.67	1.59	1.38
	(0.71)	(0.78)	(0.81)
AGE	22.26	29.38	39.29
	(1.37)	(2.76)	(2.76)
HINC	6.13	6.31	6.27
	(1.02)	(1.07)	(1.11)
MDUR	3.20	8.23	16.74
	(2.26)	(4.51)	(5.94)
GAP	0.09	-0.04	-0.02
	(0.86)	(0.75)	(0.92)
N	2,939	7,691	6,491

[a]Unweighted sample means.

Consequently, MED was defined as the logarithm of a woman's years of schooling completed plus one, so that the logarithm of zero years of schooling would equal zero. As indicated above, HINC is also measured in logarithms.

Since GAP is the residual of the estimated value of HINC, it has a zero mean for the total study population, but varies slightly from zero in specific age categories. Current earnings of husbands of younger women averaged slightly higher than their estimated earnings, while the average GAP for older women fell slightly below zero. It should also be noted that there are significant negative correlations (.7 to .8) between HINC and GAP; this indicates a tendency for current earnings to be lower than expected earning among husbands with lower earning levels, and for current earnings to exceed expected earnings by larger amounts among husbands with higher earnings. A check of outliers in the earnings equations indicated that these high zero order correlations were a statistical artifact produced by cases at extremes of the income distribution: overestimation of earnings when husbands reported zero earnings and underestimation when they reported very high earnings. These correlations disappeared when extreme cases were omitted; however, it was decided not to exclude such cases from the analysis of fertility differentials because the impact of the differential between HINC and PINC was of interest over the entire range of the income distribution.

The data in Table 39 on average marital duration (MDUR) in 1976 suggest that analysis of fertility differentials among younger women is likely to be quite sensitive to differences in exposure to the risk of conception because of the selectivity within that age group toward women who married early. The average age at marriage for women aged 20-24 in 1976 was 19.1 years, compared to 21.1 years for women aged 25-29. Relative variation in MDUR is also greater among younger women: the coefficient of variation for that group was 71 percent compared to 55 percent for 25-34 and 35 percent for 35-44. Caution is suggested in interpreting results for the youngest age category when MDUR cannot be controlled.

Analysis of Urban CEB Differentials in 1970 and 1976

Results of ordinary least squares regression analysis of differences in CEB for women grouped by broad age cate-

gories are presented in Tables 40 (1970) and 41 (1976). Three alternative regression equations were estimated for each data set. In each equation, the AGE variable was included in an attempt to control for length of exposure to risk of conception within the broader age groups; an additional equation substituting MDUR for AGE in the last alternative is also shown for 1976. Logarithms of both MED and HINC were employed after initial tests revealed nonlinearity in the relation between these variables and CEB. An education-income interaction term was also introduced to determine whether the slope of CEB with respect to income shifted with increases in education.

Interpretation of regression coefficients for MED and HINC is facilitated by the logarithmic specification, which makes them equally proportional to elasticities (the percentage change in CEB for each one percent change in MED or HINC). Dividing either coefficient by the mean of CEB gives the elasticity. Comparison between elasticities calculated from the first regression equation for each of the age groups in Tables 40 and 41 and averages for groups of lower- and higher-income countries reported by Schultz (1976) suggests that the responsiveness of CEB to changes in MED and HINC among urban Brazilian women was at an intermediate level, and that it moved in the direction of higher-income countries from 1970 to 1976. Schultz found that elasticities of average parity with respect to both mother's education and father's earnings became increasingly negative as the level of development increased.

This same tendency is observed in the Brazilian data. Elasticities for MED are greater (more negative) for younger women, and increase from 1970 to 1976. The results for HINC fall more clearly within the range of Schultz's higher-income countries. A summary of the results is as follows:

Age Group	MED		HINC	
	1970	1976	1970	1976
20-24	-.30	-.38	-.08	-.07
25-34	-.22	-.31	-.07	-.05
35-44	-.20	-.23	-.07	-.09
Lower (Schultz)	-.17	to -.06		+.05
Higher (Schultz)	-1.1	to -.19	-.11	to +.28

TABLE 40 Regression Analysis, Average Number of Children Ever Born (CEB), Married Urban Women, 1970: Brazil

Age Group	CONSTANT	MED	HINC	AGE	GAP	M*H[a]	R^2 (MSE)	F (P>F)
20-24								
(1)	1.841 (5.6)	-0.542 (14.3)	-0.145 (4.4)	0.232 (11.9)			0.15 (1.95)	163.7 (.0001)
(2)	-0.607 (1.2)	-0.424 (10.0)	0.407 (7.6)	0.236 (12.2)	-0.365 (6.1)		0.16 (1.93)	133.8 (.0001)
(3)	-0.274 (0.5)	-0.618 (3.2)	-0.466 (5.7)	0.236 (12.2)	-0.383 (6.2)	0.036 (1.8)	0.16 (1.93)	107.3 (.0001)
25-34								
(1)	0.064 (0.2)	-0.765 (21.7)	-0.265 (9.5)	0.201 (22.4)			0.17 (4.91)	520.5 (.0001)
(2)	2.846 (8.1)	-0.513 (13.1)	-0.797 (12.1)	0.199 (22.5)	-0.746 14.0)		0.19 (4.79)	449.6 (.0001)
(3)	3.727 (8.4)	-1.017 (6.5)	-0.965 (14.0)	0.199 (22.6)	-0.797 (14.4)	0.092 (3.3)	0.19 (4.78)	362.3 (.0001)
35-44								
(1)	5.672 (9.4)	-1.022 (18.1)	0.362 (9.2)	0.066 (4.6)			0.11 (11.09)	263.1 (.0001)
(2)	10.442 (6.5)	-0.611 (9.7)	-1.292 (17.0)	0.067 (4.8)	-1.194 (14.2)		0.14 (10.76)	253.1 (.0001)
(3)	12.308 (15.8)	-1.743 (7.5)	-1.640 (15.9)	0.067 (4.7)	-1.348 (15.0)	0.203 (5.0)	0.14 (10.68)	208.4 (.0001)

Note: t statistics are in parentheses.

[a]Interaction term: MED*HINC.

TABLE 41 Regression Analysis, Average Number of Children Ever Born (CEB), Married Urban Women, 1976: Brazil

Age Group	CONSTANT	MED	HINC	AGE	GAP	M*H[a]	R^2 (MSE)	F (P>F)
20-24								
(1)	-1.137	-0.552	-0.097	0.184			0.16	186.4
	(3.3)	(17.3)	(4.4)	(12.2)			(1.27)	(.0001)
(2)	0.334	-0.400	-0.381	0.187	-0.377		0.18	161.5
	(0.9)	(11.0)	(9.6)	(12.6)	(8.6)		(1.24)	(.0001)
(3)	-0.098	-0.288	-0.341	0.187	-0.372	0.019	0.18	129.3
	(0.2)	(1.7)	(4.7)	(12.6)	(8.3)	(0.6)	(1.24)	(.0001)
(4)[b]	3.043	-0.414	-0.387	0.322	-0.241	0.045	0.47	506.8
	(9.1)	(3.0)	(6.6)	(42.3)	(6.6)	(11.9)	(0.81)	(.0001)
25-34								
(1)	-0.754	-0.887	-0.143	0.203			0.23	758.2
	(3.0)	(28.2)	(6.5)	(27.3)			(3.40)	(.0001)
(2)	1.659	-0.657	-0.599	0.206	-0.615		0.25	635.9
	(5.6)	(18.8)	(15.6)	(28.0)	(14.4)		(3.31)	(.0001)
(3)	2.729	-1.178	-0.787	0.207	-0.651	0.088	0.25	512.0
	(6.4)	(7.8)	(12.0)	(28.1)	(14.9)	(3.5)	(3.30)	(.0001)
(4)[b]	6.538	-1.300	-0.822	0.244	-0.519	0.154	0.43	1441.2
	(20.0)	(9.9)	(14.4)	(59.3)	(13.6)	(7.1)	(2.52)	(.0001)
35-44								
(1)	5.403	-1.040	-0.422	0.085			0.14	360.6
	(9.8)	(19.6)	(11.5)	(6.5)			(8.70)	(.0001)
(2)	9.659	-0.678	-1.253	0.097	-1.082		0.17	323.3
	(15.6)	(11.7)	(18.4)	(7.6)	(14.4)	(8.8)	(8.45)	(.0001)
(3)	13.004	-2.437	-1.842	0.099	-1.263	0.295	0.18	278.1
	(17.1)	(10.2)	(17.8)	(7.8)	(16.0)	(7.5)	(8.37)	(.0001)
(4)[b]	14.164	-2.546	-1.882	0.168	-1.179	0.330	0.27	483.2
	(25.0)	(11.3)	(19.4)	(30.2)	(16.0)	(9.0)	(7.51)	(.0001)

Note: t statistics are in parentheses.

[a]Interaction term: MED*HINC.
[b]Marital duration (MDUR) substituted for age.

At 1970 mean levels of MED and CEB, the 48 percent increase in the average number of years of schooling achieved by women in the 25-34 age group (recalling that MED = log [years of school + 1]) would account for an 11 percent decline in CEB. While these results suggest that Brazilian experience during the early 1970s was consistent with patterns observed among lower-middle income countries, the elasticities of CEB with respect to father's earnings appear to lean more toward the negative values characteristic of higher-income countries than do those for MED.

One reason for this could be the earnings gap hypothesis discussed above: that the effects of earnings on CEB can be positive within a given reference group even if the overall relation between CEB and HINC is negative. The second set of regression equations, which incorporates the GAP variable, confirms this. The regression coefficient for GAP is negative, implying that the more husband's estimated earnings (PINC) exceed actual earnings (HINC), the lower is the average observed CEB. In a society like Brazil in which income differentials are associated with a variety of sociocultural factors that could influence reproductive behavior, it makes sense to look for the effect of income on fertility within rather than between specific reference groups.

Similar considerations raise the question of whether an interaction with sociocultural factors associated with differences in educational attainment affects the regression results for MED and HINC. The third set of regression equations includes an interaction term. This term is statistically significant in both 1970 and 1976 for women in the 25-34 and 35-44 age groups because of the large sample size; addition of the variable affects only the third digit of R-square. The term's positive sign indicates that with increases in MED, the negative impact of HINC on CEB is attenuated, as is the effect of MED as HINC increases. This is what one would expect given the variety of sociocultural influences described earlier.

As noted above, the variable AGE was included in all three variants of the regression equations as a control for differences in the risk of exposure to conception within each of the broader age groups. Marital duration is a better measure of such risk, but was not included in the 1970 census. However, it was incorporated in the 1976 survey, and equation (4) in Table 41 substitutes MDUR for AGE to provide some measure of the effect of using AGE as the measure of exposure to risk. As one would expect, AGE

appears to be least satisfactory for younger women, for whom both absolute and relative variation in CEB was more sensitive to MDUR than AGE. It is interesting to note that while the coefficients for MED and HINC increased in negative magnitude with the addition of MDUR, the impact of GAP was reduced; this suggests that the effect on CEB of the relative status captured by GAP may be tied to marital duration. Among younger women whose husband's earnings fall below the expected level, lower CEB could be the result of longer intervals between marriage and first birth, a point that deserves further exploration.

Concern about MDUR is warranted because of its implications for interpreting changes in CEB from 1970 to 1976. The extent of this concern will depend on one's confidence in the conclusions derived earlier from census and survey data: that average ages at marriage and first birth did not change substantially between 1970 and 1976, and that most of the decline in total fertility can be attributed to a decline in marital fertility rather than to changes in the proportions married. The issue is less important to determining how much changes in socioeconomic status contributed to declines in CEB than to examining how those changes were translated into declines via the proximate determinants of fertility.

Sources of Change in CEB from 1970 to 1976

Regression analyses of differences in CEB also can be used to identify sources of change in CEB from 1970 to 1976. As noted earlier, an important question is whether such change resulted from a redistribution of women according to socioeconomic characteristics or from a shift in the parameters relating these characteristics to CEB. One approach is to evaluate the regression coefficients reported in Tables 40 and 41 using sample means, and then examine changes in the contribution of each variable to the level of CEB for the two dates. With two sets of regression results, there are three ways that one can proceed: forward using 1970 coefficients with means for both dates, backward using 1976 coefficients with both sets of means, or by comparing means and coefficients for each date. Changes in the average value of CEB could be the result of changes in educational attainment or other variables included in the regressions, changes in regression coefficients, or shifts in conditions that are not measured, but are reflected in the constant term. The

first two variants of this approach hold the coefficients constant, but will give different results to the extent that coefficients have changed; by definition there is no change in the constant term. The third variant allows for change in the constant, but confuses changes in composition with shifts in coefficients. An alternative approach is to reestimate coefficients and include both a dummy variable for time to capture shifts in the constant term, and interaction terms for time and each of the variables in the regression to measure changes in regression coefficients. The new estimators can then be evaluated at both sets of sample means to determine the contribution of changes in composition to observed changes in the level of CEB. Both of these approaches have been attempted.

Table 42 presents the first approach: the first column represents changes with the 1970 regressions; the second column represents changes with the 1976 regressions; and the third column shows the difference between the evaluation of 1970 regressions with 1970 means and the 1976 regressions with 1976 means. The third set of regressions in Tables 41 and 42 (with the interaction term) was used for the two older age categories where interactions were significant. The total of changes in each group of coefficients adds to the estimated change in CEB for that group; by definition, the estimated change in CEB equals the actual change in the last column.

In the first two variants, estimated changes exceed the actual in all cases, especially using the 1970 coefficients and in the case of older women; this suggests some combination of change in coefficients and in the constant term. Changes in the average level of husbands' earnings appear to have had a greater impact than maternal education, more so in 1970 than in 1976, which suggests an attenuation in the importance of the earnings effect. An important fraction of the negative effects of MED and HINC is offset by the positive MED*HINC interaction term. Compared to MED and HINC, changes in the GAP variable had little effect; in fact, a slight narrowing of the average GAP contributed a slightly positive impetus to average CEB. Shifts in age composition also raised CEB for older women.

The third variant is useful mainly in illustrating how the combined effects of changes in composition and in coefficients relate to changes when coefficients are held constant. For example, the effect of changes in the HINC coefficient and the average level of HINC would have contributed to an increase of .562 in CEB among women aged

TABLE 42 Changes in Contribution of Independent Variables to Levels of CEB, 1970 and 1976: Brazil

Age Group and Variable	1970 Regression Coefficients	1976 Regression Coefficients	Combined Coefficients
20-24			
CONSTANT	0	0	0.914
AGE	0.014	0.011	-1.072
MED	-0.152	-0.143	-0.112
HINC	-0.220	0.208	-0.094
GAP	-0.006	-0.006	+0.005
CEB	-0.351	-0.335	-0.332
25-34			
CONSTANT	0	0	-0.998
AGE	-0.021	-0.022	+0.206
MED	-0.309	-0.357	-0.564
HINC	-0.566	-0.462	0.562
GAP	0.027	0.022	0.021
INTERACTION	0.245	0.236	0.210
CEB	-0.624	-0.583	-0.563
35-44			
CONSTANT	0	0	0.696
AGE	0.008	0.011	1.261
MED	-0.379	-0.530	-1.340
HINC	-0.938	-1.054	-2.213
GAP	-0.027	-0.026	-0.029
INTERACTION	0.409	0.595	1.029
CEB	-0.929	-1.004	-0.363

25-34 had there not been offsetting changes in MED and the constant. Since both types of change are clearly operative, the alternative approach to decomposition using reestimated coefficients with dummy variables for interactions with time should be helpful, particularly for the 25-34 age group.

Table 43 presents estimates of the regression coefficients using the combined 1970 and 1976 data files. Four additional variables have been added: a dummy for time, and one interaction term each for time and MED, HINC, and GAP. These four variables should account for changes in the constant term and in coefficients for those three variables. These regressions confirm what Table 42 suggested about changes in coefficients for women in the middle and upper age categories. For women in the 25-34 age group, the negative effect of husband's earnings is

TABLE 43 Regression Analysis and Test for Interactions, Merged 1970 and 1976 Data Files: Brazil

Variable	Age Group 20-24	25-34	35-44
CONSTANT	-0.103 (0.3)	3.628 (9.8)	11.704 (18.6)
MED	-0.425 (11.1)	-1.017 (7.0)	-1.740 (7.9)
HINC	-0.398 (8.3)	-0.965 (15.2)	-1.641 (16.9)
AGE	0.212 (17.6)	0.203 (35.6)	0.083 (8.7)
GAP	-0.363 (6.7)	-0.797 (15.6)	-1.348 (15.9)
INTERACTION	--	0.092 (3.6)	0.203 (5.3)
TIME	-0.057 (0.2)	-0.781 (1.5)	1.970 (2.5)
HINC*TIME	0.002 (0.0)	0.183 (1.9)	-0.205 (1.4)
MED*TIME	0.035 (0.6)	-0.150 (0.7)	-0.666 (2.0)
GAP*TIME	0.027 (0.4)	0.147 (2.1)	0.068 (0.6)
INTERACT*TIME	--	-0.007 (0.2)	0.088 (0.6)
R^2 (MSE)	0.18 (1.58)	0.23 (4.05)	0.16 (9.65)
F (F>P)	159.6 (.0001)	459.0 (.0001)	248.1 (.0001)

attenuated. This shows up in the HINC*TIME coefficient, as well as in INTERACTION*TIME; the MED*TIME coefficient is not significant. For women aged 35-44, there is a significant increase in the constant term and a decline in the impact of education.

When the regression results for the merged files are used to decompose change, the results are consistent with

those reported in Table 42 in the relative impact of the variables. The main point that stands out in Table 44 is that the decline in the negative impact of husband's earnings over time for women aged 25-34 results from a change in the value of the regression coefficient, as does the rather large increase in the impact of earnings for women aged 35-44. This, plus changes in the constant

TABLE 44 Decomposition of Changes in Average Parity from 1970 to 1976 Using Regression Coefficient for Merged Data: Brazil

	Age Group		
Variable	20-24	25-34	35-44
MED	-0.124	-0.308	-0.378
HINC	-0.217	-0.567	-0.939
AGE	0.013	-0.022	0.009
GAP	0.006	0.027	-0.027
INTERACTION	--	0.246	0.413
TIME	-0.057	-0.781	1.970
MED*TIME	0.059	-0.243	-0.922
HINC*TIME	0.021	1.162	-1.130
GAP*TIME	-0.003	-0.006	-0.002
INTERACT*TIME	--	-0.068	-0.772
CEB - ESTIMATED[a]	-0.331	-0.559	-0.402
CEB - OBSERVED	-0.332	-0.563	-0.363

Note: Interaction term not significant; see text.
[a]Totals may vary due to rounding.

term (as reflected in the change attributed to TIME), suggests that some important structural shifts accompanied the changes in composition by MED and HINC and contributed to declines in CEB.

What is puzzling is that these shifts do not show up in the GAP variable, which, despite its importance in explaining differentials in CEB, does not appear to contribute much to changes in CEB between 1970 and 1976. One reason for this could be that changes in the average level of GAP are not the appropriate place to be looking for the effects of changes transmitted through that variable. GAP was introduced to measure the effect of inflationary conditions and changes in the distribution of earnings on the economic position of households. Therefore, changes in the average level of GAP should be less relevant than changes in its distribution.

Table 45 examines changes in the distribution of GAP between 1970 and 1976 and indicates the possible impact of such changes on CEB. The table shows the percent of women in each age category, broken down by deciles of family income, residing in families whose husband's earnings fall more than one standard deviation from the mean level of GAP for that age group. The table also shows in parentheses the relative weight (as a percent of all women in the age group) of these women in total CEB. These data suggest that for certain groups (e.g., ages 25-34 in middle-income deciles) there may have been a greater dispersion of GAP in 1976. However, the table also shows that this increase in dispersion was probably not great enough to have made a major difference in changes in the average level of CEB over the period under study. In this connection, it is important to note that the relative earnings effect expressed in GAP does appear to make a difference in the explanation of differentials in CEB in both 1970 and 1976. The point is that GAP (and the structural changes it measures, perhaps quite inadequately) does not appear to account for much of the change in CEB between 1970 and 1976.

Thus our assessment of the components of changes in CEB from 1970 to 1976 indicates that increases in the educational attainment of married women in Brazil and increases in their husbands' earnings contributed significantly to the decline of average CEB. At the same time, structural change is not ruled out. Clearly, the role of that change is suggested by the significant and somewhat erratic shifts in the values of the regression coefficients for HINC, as well as changes in the constant terms in regres-

TABLE 45 Percent of Women with GAP Greater than One Standard Deviation from Mean, 1970 and 1976: Brazil

Age Group and Year	Income Deciles 1-3	4-6	7-10	All Groups
20-24				
1970	29.8 (3.6)	6.5 (2.5)	3.4 (1.7)	7.8
1976	21.5 (3.4)	5.5 (2.1)	2.6 (1.2)	6.7
25-34				
1970	35.3 (3.8)	4.4 (1.4)	3.6 (2.0)	7.2
1976	32.2 (4.1)	8.9 (2.8)	2.9 (1.6)	8.5
35-44				
1970	31.4 (3.1)	5.8 (1.5)	2.3 (1.5)	6.1
1976	34.3 (3.3)	12.7 (3.4)	3.8 (2.4)	9.1

Note: The relative contributions of each group to total children ever born, expressed as a percent of all women in the age group, are shown in parentheses.

sions for the 25-34 and 35-44 age groups. It is also clear that the conceptual limitations of census and multipurpose national sample survey data do not permit a detailed pursuit of the nature of these shifts.

RURAL WOMEN

Prior to 1970, fertility rates among rural Brazilian women were constant or rising at the national level. Regional declines in the South and Southeast were offset by constant or increasing rates in the Northeast and Frontier areas. The impact of this sluggishness in rural fertility decline on overall fertility rates was offset by declines in the share of rural areas in total population; rapid out-migration from rural areas more than offset the higher rural rate of natural increase. With the advent of a decline in natural increase in rural areas, the rural population declined absolutely during the 1970s.

The rural exodus that has characterized the last three decades of Brazilian demographic experience was triggered

by a combination of social, economic, and political forces, many of them longstanding features of rural Brazilian society. One of the most basic of these is the combination of a limited supply of good land and increasing population pressure; droughts and infertile soil have plagued areas with a high concentration of rural population, particularly in the Northeastern states. A second force is the unequal distribution of land, with substantial proportions of rural families being forced to eke a subsistence out of minifundia holdings of fewer than five hectares. A third is that there has been increased consolidation of land holdings accompanying the commercialization of Brazilian agriculture; this process has received additional stimulus from the energy crisis and Brazil's resultant need to raise foreign exchange through agricultural exports and increase production of alcohol as a substitute for petroleum imports. This lack of opportunity in rural areas, combined with hopes of paid employment and urban amenities, has motivated Brazil's rural-urban migration.

While migration was the primary demographic response to adverse socioeconomic conditions among the masses of Brazil's rural population, other demograhic processes were affected, including fertility and family formation. Chapter 3 suggested several hypotheses about how such changes might be affecting rural fertility in Brazil. All focus in one way or another on the role of children as both immediate productive resources and longer-term investments for rural families, and on how changes in rural socioeconomic and institutional conditions could have affected this role.

One hypothesis relates to land availability. As the amount of land available to farm families in more densely settled areas is reduced, several forces that could motivate not only out-migration, but also lower fertility are set in motion. For families remaining in agriculture that wish to transmit land to their children through inheritance, large numbers of children will lead to an uneconomical subdivision of plots; this can be avoided only by having fewer children, forcing children to start their own families later, or encouraging the children's migration. The value of children as immediate productive resources will also be affected to the extent that smaller plots reduce the need for child labor.

The influence of these forces on reproductive behavior is mediated by institutional factors and by the availability of new land in other areas. Research on land avail-

ability and fertility in rural Brazil using data from the 1970 censuses of population and agriculture found that fertility was lower in more densely settled regions of Southeastern Brazil and higher in areas of new rural settlement in the Central-Western region (Merrick, 1974). An extension of that research to Northeastern Brazil and to the frontier settlements in the Amazon region did not reveal similar patterns (Merrick, 1981). Several reasons for this were suggested: Amazon settlement really did not get underway until after 1970, and the very unequal distribution of access to land in the Northeast was not as conducive to the pattern observed in the South, here a higher proportion of family farms were owner-operated.

Research with 1970 data also revealed the very severe limitations of population census data for dealing with links between rural demographic changes and socioeconomic and institutional factors affecting those changes. These limitations were overcome to some extent by combining population census data with information from the agricultural census. Analysis of changes during the 1970s will have to await the availability of detailed information from the 1980 censuses of agriculture and population. Unfortunately, the PNAD surveys taken during the 1970s do not provide the geographic detail required for linking them to results of the 1975 agricultural census; moreover, the PNAD sample does not include rural areas of the Central-West and Amazon regions, so that the potential positive effects on fertility of frontier settlement in those regions during the 1970s cannot be examined.

Some features of the relationship between fertility decline in rural Brazil during the 1970s and socioeconomic change in the areas included in the PNAD surveys can be studied. One of these relates to an institutional factor mediating the response to increasing economic pressures, such as scarcity of land and consolidation of land in larger holdings, on the demographic responses of farm families. This factor is rural proletarianization, or the shift from an owner-operator and farm family labor mode of production to wage labor. As noted earlier, European experience, as well as evidence from Southern Brazil, indicates that lower fertility is more likely to result from a scarcity of land when farm families own their land and reduced fertility allows them to maintain control of the land. Rural proletarianization weakens this motivation. As noted in Chapter 3, Paiva (1982) disagrees with this interpretation for Brazil. He argues that proletarianization reduces the value of children as farm

laborers and provides incentives for reduced fertility, including increased market work for both women and children. The potential value of market work would be increased by education, and by a shift toward quality rather than quantity of children.

The data with which to evaluate these two interpretations of Brazilian experience are scant. Tabular evidence presented in Chapter 3 indicated that average parity was indeed lower in regions with higher levels of proletarianization (measured according to the proportion of rural household heads reported as employees); in the same tables, however, average parity was higher rather than lower for proletarian households within those regions. While one must be careful to avoid the fallacy of composition, one must also be careful about bias arising from the location of families when their characteristics have been measured in census and survey data. For rural areas, those data detect only that proportion of the proletarianized population remaining at the time interviews were conducted; those who moved (either to urban areas or to other rural areas) and who may well have had lower fertility would not be included.

Another aspect of change in rural fertility relates to the socioeconomic differentials observed in Chapter 2. While these differentials were not as great as those observed in urban areas, the data presented in Chapters 2 and 3 indicated that rural women with some education had lower fertility than those with no education, and that the proportion of rural women with some education increased from 1970 to 1976. Also, rural women with no education as a percent of all women aged 15-49 declined from about 21 percent to about 13 percent, a result of some combination of increases in educational attainment among rural women, out-migration, and possible underrepresentation of less-educated rural women in the PNAD survey. Such evidence suggests that the role of education should not be neglected in examining rural fertility differences.

Analysis of Rural CEB Differentials in 1970 and 1976

As indicated above, neither the 1970 census nor the 1976 PNAD survey provides many meaningful measures of concepts relevant to the analysis of changes in rural fertility in Brazil. The multivariate analysis that follows is presented primarily to illustrate how the relationships between differences in average parity and socioeconomic

variables described for urban women compare to the case of rural women. No pretense is made of even approximating a comprehensive explanation of changes in rural reproductive patterns based on these data.

Table 46 lists the variables included in the analysis. Average parity (CEB) is the dependent variable, and education of women (MED) is included in logarithmic form as it was for urban women. Census and survey measures of income and earnings had so little conceptual content for the rural population that they were quickly abandoned. Husband's education (HED) has been substituted as a proxy measure of earnings potential, but no attempt was made to calculate the gap between actual and potential earnings. Two additional dummy variables were employed: one for residents of Northeastern states (NE), included to pick up the effects of regional differences in economic and social structure not reflected in education, and one to indicate if the household was proletarian (PROL), based on whether or not the husband's status was reported as employee or paid farm laborer.

Unweighted means and standard deviations of these variables are shown in Table 47. Average CEB declined by 12 percent for married women aged 20-24, 6 percent for

TABLE 46 Variable Labels and Definitions, Rural Women: Brazil

Variable	Definition
CEB	Average parity: number of live children ever born as reported in 1970 census and 1976 PNAD survey.
AGE	Mother's age: in years.
MED	Mother's education: natural logarithm of the number of years of school completed, defined as follows: MED=log (years +1), so that log (0 years)=0.
HED	Father's education: natural logarithm of the number of years of school completed, defined as follows: HED=log (years +1), so that log (0 years)=0.
NE	Northeast: dummy variable equal to one for residents of northeastern states.
PROL	Proletarian: dummy variable equal to one when employment status of father is rural wage labor.

TABLE 47 Means[a] (standard deviations) of Variables Used in Analysis of Differences in Average Parity for Rural Women, 1970 and 1976: Brazil

Year and Variable	Age Group 20-24	25-34	35-44
1970			
CEB	2.21 (1.70)	4.42 (2.71)	6.79 (3.82)
MED	0.52 (0.66)	0.53 (0.67)	0.41 (0.61)
HED	0.53 (0.66)	0.56 (0.67)	0.49 (0.64)
AGE	22.07 (1.42)	29.17 (2.87)	39.01 (2.79)
NE	0.45 (0.49)	0.43 (0.50)	0.43 (0.50)
PROL	0.31 (0.46)	0.30 (0.46)	0.26 (0.44)
N	2,456	4,880	4,108
1976			
CEB	1.95 (1.50)	4.14 (2.57)	6.73 (3.62)
MED	0.90 (0.75)	0.78 (0.74)	0.61 (0.70)
HED	0.84 (0.74)	0.76 (0.73)	0.65 (0.71)
AGE	22.17 (1.42)	29.26 (2.85)	39.21 (2.89)
NE	0.32 (0.47)	0.33 (0.47)	0.31 (0.46)
PROL	0.48 (0.50)	0.43 (0.49)	0.38 (0.48)
N	2,344	5,247	4,615

[a]Unweighted sample means.

those aged 25-34, and less than 1 percent for those aged 35-44. Relative variation in average CEB was somewhat lower for rural than for urban women. For women in the 25-34 age group, the coefficient of variation (ratio of the standard deviation to the mean) was 0.61 in 1970 compared to 0.7 for urban women. In 1976, relative variation increased, and was close to the level observed for urban women. There was a greater proportional increase in average education for women than for men, with the greatest increase occurring among ages 20-24. The Northeast was represented less in 1976 because of a smaller sampling fraction for that region in PNAD (as well as possible underrepresentation in the sample). The proportion of women in proletarian households increased for all three age groups, again with the greatest increase among younger women.

Multivariate regression results for 1970 are presented in Table 48, and those for 1976 in Table 49. Separate regressions were run for each of the three broad age categories, with a control for age within each category as well. Three regressions were selected for each group: the first includes, in addition to AGE, the education variables MED and HED; the second adds the dummy variable for the Northeastern states (NE); and the third includes the dummy variable for proletarian households (PROL). Since both MED and HED enter in log form, their regression coefficients are again proportional to elasticities (which are derived by dividing the coefficients by the sample mean value of CEB).

A summary of the elasticities of CEB with respect to average MED and HED is as follows:

Year	20-24		25-34		35-44	
	MED	HED	MED	HED	MED	HED
1970	-.16	-.06	-.10	-.02	-.04	-.01
1976	-.16	-.10	-.15	-.06	-.07	-.08

Compared to the results for urban women, the responsiveness of CEB to increases in MED is one-third to one-half as great for rural women, and the increase in responsiveness from 1970 to 1976 is smaller. Compared to results for the range of countries reported by Schultz (1976), results for older rural Brazilian women are close to the bottom of the range of elasticities for lower-income countries (-.17 to -.04) and for younger women near the top.

Although addition of the dummy variable for residence in Northeastern states (the second set of equations) does not add significantly to the amount of variance explained,

TABLE 48 Regression Analysis, Average Number of Children Ever Born (CEB), Married Rural Women, 1970: Brazil

Age Group	CONSTANT	MED	HED	AGE	NE	PROL	R^2 (MSE)	F (P>F)
20-24								
(1)	-4.317	-0.352	-0.163	0.308			0.09	84.5
	(8.46)	(5.62)	(2.56)	(13.31)			(2.634)	(.0001)
(2)	-4.399	-0.335	-0.136	0.308	0.120		0.09	64.1
	(8.58)	(5.28)	(2.11)	(13.32)	(1.65)		(2.632)	(.0001)
(3)	-4.415	-0.335	-0.136	0.307	0.129	0.083	0.10	51.6
	(8.61)	(5.27)	(2.08)	(13.29)	(1.76)	(1.17)	(2.632)	(.0001)
25-34								
(1)	-4.342	-0.470	-0.162	0.312			0.13	239.8
	(11.67)	(6.90)	(2.40)	(24.65)			(6.421)	(.0001)
(2)	-4.598	-0.440	-0.087	0.314	0.338		0.13	185.0
	(12.22)	(6.42)	(1.24)	(24.82)	(4.25)		(6.398)	(.0001)
(3)	-4.645	- .436	-0.091	0.314	0.344	0.090	0.13	148.3
	(12.27)	(6.36)	(1.28)	(24.85)	(4.23)	(1.13)	(6.398)	(.0001)
35-44								
(1)	0.721	-0.346	-0.229	0.162			0.02	28.6
	(0.87)	(2.98)	(2.06)	(7.65)			(14.32)	(.0205)
(2)	0.097	-0.290	-0.086	0.168	0.679		0.03	28.8
	(0.12)	(2.49)	(0.75)	(7.95)	(5.38)		(14.23)	(.0393)
(3)	0.085	-0.289	-0.086	0.168	0.681	0.027	0.03	23.1
	(0.10)	(2.48)	(0.75)	(7.96)	(5.36)	(0.20)	(14.23)	(.0273)

Note: t statistics are in parentheses.

TABLE 49 Regression Analysis, Average Number of Children Ever Born (CEB), Married Rural Women, 1976: Brazil

Age Group	CONSTANT	MED	HED	AGE	NE	PROL	R^2 (MSE)	F (P>F)
20-24								
(1)	-2.803	-0.339	-0.238	-0.237			0.11	100.3
	(6.10)	(7.22)	(5.03)	(11.49)			(2.009)	(.0001)
(2)	-3.017	-0.318	-0.194	0.242	0.235		0.12	78.5
	(6.51)	(6.78	(3.94)	(11.69)	(3.45)		(2.000)	(.0001)
(3)	-3.021	-0.320	-0.194	0.241	0.236	0.005	0.12	62.8
	(6.49)	(6.78)	(3.94)	(11.68)	(3.42)	(0.08)	(2.000)	(.0001)
25-34								
(1)	-4.495	-0.650	-0.362	0.322			0.20	428.1
	(13.55)	(12.42)	(6.85)	(28.72)			(5.325)	(.0001)
(2)	-4.768	-0.621	-0.268	0.322	-0.519		0.20	337.2
	(14.34)	(11.88)	(4.95)	(28.89)	(7.22)		(5.273)	(.0001)
(3)	-4.861	-0.617	-0.266	0.323	0.540	0.140	0.21	270.9
	(14.51)	(11.80)	(4.91)	(28.96)	(7.44)	(2.17)	(5.270)	(.0001)
35-44								
(1)	1.009	-0.555	-0.731	0.167			0.07	111.6
	(1.43)	(6.40)	(8.48)	(9.36)			(12.251)	(.0001)
(2)	0.304	-0.468	-0.546	0.171	1.204		0.09	112.9
	(0.43)	(5.44)	(6.27)	(9.69)	(10.43)		(11.97)	(.0001)
(3)	0.222	-0.462	-0.541	0.171	1.219	0.105	0.09	90.5
	(0.31)	(5.36)	(6.20)	(9.72)	(10.47)	(0.99)	(11.97)	(.0001)

Note: t statistics are in parentheses.

the regression coefficient is significant for the two older age groups. This indicates an interaction between education and residence rather than an additive effect. Tests for the interaction suggested that MED slopes were lower in the Northeast, though so few rural women in that region reported any education that it was difficult to judge the significance of the results.

The third set of equations attempted to assess the impact of proletarianization on average CEB. The results were consistent with the tabular results in Chapter 3, which suggested that CEB was slightly higher in proletarian rural households. When other variables were controlled, however, this difference was significant only for women in the 25-34 age group in 1976. These results confirm the point made earlier that an adequate test of the proletarian hypothesis will require a more precise measurement of the process of proletarianization that captures present and previous residence and occupational status, as well as a richer depiction of the institutional forces underlying that process.

Changes in Rural CEB from 1970 to 1976

The change in average CEB from 1970 to 1976 that can be accounted for in the regression analysis results from increased educational attainment. In this connection, it should be recognized that most of the observed change is not explained by changes in the variables included in the regressions. It is hoped that the case study data reported in Part II of this report will provide richer insight into the nature of changes in rural fertility than do aggregate census and sample survey data.

CONCLUSIONS

Most of the variance in average parity that can be explained by application of multivariate regression analysis to data on individual married women from the Brazilian census and PNAD survey relates to modernization variables--education and average earnings. Most of the change that can be accounted for between 1970 and 1976 relates to increases in these two variables. The attempt to incorporate a variable measuring the relative economic position of urban households indicated that there was a positive association between fertility and relative eco-

nomic status; that is, CEB was higher on average for women whose husbands' current earnings exceeded the level of earnings that would be expected given their education and other characteristics. However, decomposition of changes in CEB from 1970 to 1976 did not show that a change in GAP contributed to fertility decline.

These regression results do not suggest that increased modernization was the only reason for the change in Brazilian fertility. Changes in regression coefficients and in constant terms in the regression equations suggested that a variety of unmeasured factors could account for the unexplained variance. Measures that were available in the census and survey data provided little insight into the nature of such changes, whether related to increased access to contraception through public or private channels, or to institutional changes associated with shifts in the Brazilian model of socioeconomic development.

It should also be recognized that average parity is a poor measure of fertility for purposes of accounting for change. It is a cumulative variable, and comparisons of averages for different groups at different dates measure the result of a demographic process rather than the process itself. As noted above, it would have been better to use current fertility as measured by births reported for the year prior to the interview; however, as reported in Chapter 2, the performance of that measure inspired more confidence in its robustness for work with subgroups of the population. Attempts to derive other measures (such as the length of the first open birth interval) from these data files proved equally unrewarding.

Data limitations curtailed even further the analysis of differences and the decomposition of changes in the average parity of rural women. The main finding for these women was that increased educational attainment contributed most to the explanation of variance, though only a limited portion of the total variance was explained by the regressions. Some doubts were raised about the hypothesis that proletarianization contributed to fertility decline; however, caution was suggested about the validity of using data on rural women classed as proletarian at the time of the interview to test this hypothesis, rather than using the experience of the proletarianization process.

It was also impossible to link what the census and survey data reported about the demographic characteristics of individual rural residents and their families to economic characteristics of their farms and institutional features of their localities. For this reason, the study

could not explore hypotheses relating fertility decline to changes in land availability, reduced need for child labor, and increased nonfarm economic activity for rural women and children. The census and survey data files did include questions on school attendance that merited further study. Information on child labor was included in agricultural censuses, but not in the demographic censuses and surveys. If Brazil is ever to conduct a fertility survey patterned after the World Fertility Survey, it would focus ideally on these elements of rural socioeconomic structure, as well as those aspects of change in urban areas that are not covered by currently available census and survey data.

PART II FERTILITY DETERMINANTS AT THE LOCAL LEVEL

CHAPTER 5

THE NIHR: PURPOSE AND METHODOLOGY

As noted in the Introduction, the discussion in this and the following chapters parallels Part I, but with a local- rather than a national-level focus. There are, of course, advantages to be gained from both: the national-level analysis permits aggregate conclusions and hypotheses, however tentative; the local-level data examined in the following pages provides another, complementary perspective on those perceptions. These chapters examine the purpose and methodology of the NIHR; levels and trends in the total fertility rate for the nine local contexts studied; and the effects of nuptiality, marital fertility patterns, the proximate determinants, and socioeconomic factors, specifically income, on fertility for the nine contexts. The final chapter shows that the national-level and the local-level conclusions are consistent.

The NIHR was conducted between May 1975 and March 1977 by Centro Basileiro de Analise e Planejamento (CEBRAP) in Sao Paulo, under the financial auspices of the International Development Research Centre (IDRC, Canada), the Population Council (USA), and Financiadora de Estudos e Projectos (FINEP, Brazil). It consists of a series of local case studies based on a view of population dynamics as part of the overall structural dynamics of society, with economic determinants (manpower requirements, forms and degrees of accumulation, property patterns, etc.) having a decisive influence. However, this dominance of socioeconomic factors over population dynamics does not operate in an obvious way. Therefore, rather than simply assuming such relations, it is essential to examine analytically and empirically how they are established. Although structures condition behavior, and behavior only exists through the actions of individuals (with their

aspirations, motivations, forms of personality, individually calculated interests, etc.), the mediation between structures and action is essential. If the mediations are not taken into account, the analysis must inevitably become static. The result is the deduction of rigid prescriptions for action from structural patterns, or, at the opposite extreme, the dissolution of social conditioning factors into the subjectivity of the individual agents, so that the only way to understand human reproduction is to take a purely psychological approach. The NIHR perspective takes the role of social institutions--the Church, private enterprise, the educational system, the medical system, and so on--as being crucial to such mediation. The way population practices and values are actually realized, and population policies defined, depends on how population is seen in the context of these institutions, and how, within each one, interests and values concerning the family, number of children, procreation, and family planning are articulated.

The NIHR began by choosing the areas of Brazil that would represent as purely as possible the different forms in which the production is organized. A two-dimensional typology of the areas was then developed according to their dominant forms of production and their place in the process of development.[2] In the former category, three modes were distinguished, each of which might predominate in a given area, although in combination with the others: the capitalist mode, a system of small autonomous producers, and rural servitude. The capitalist form was subdivided into monopolistic and competitive; for the small autonomous producers, the distinction was between rural and urban. The second dimension, place in the process of development, was based on the assumption that development tends to concentrate economic activities and population in certain areas, and to disperse them in others. The former were classed as "concentration areas," which are invariably urban; the latter were labeled "dispersion areas," which as a rule comprise extractive or agricultural activities, with the formation of frontiers at the edges of an overexpanding transportation system. This classification also left room for certain areas, labeled "interstitial," which fall between the types described above, and which tend to lose activities and population; these areas may be either urban or rural.

These two dimensions could produce a total of 15 possible types. However, four of these were discarded as

meaningless: the monopolistic and interstitial capitalist area; simple commodity production with an urban location in a dispersion area; simple commodity production with a rural location in a concentration area; and rural servitude in a concentration area. The monopolistic capitalist area undergoing dispersion was also discarded since it was considered highly rare in its pure state in Brazil; moreover, within a given gradient, it might appear in some regions classified as competitive-capitalist in a dispersed form. Finally, rural servitude in an interstitial form was also omitted since this combination might be found, at least partially, in regions defined as simple commodity production with a rural location and interstitial form.

The next stage of analysis consisted of making the nine remaining possibilities correspond to actual regions in Brazil. Regions were distributed both spatially and, whenever possible, according to the dual classification. The results are shown in Table 50; the contexts selected are described in detail in the Appendix. The nine areas chosen cover seven municipalities (for the sake of convenience, the rural and urban categories in the system of autonomous producers are represented by the rural and urban areas of the same municipalities, thus yielding nine area types and only seven municipalities). These municipalities are distributed over six states: Sao Paulo, Rio Grande do Sul, Pernambuco, Espirito Santo, Para, and Piaui. The map of Brazil (see page 14) gives an idea of this geographical distribution.

For each of the nine chosen areas, two types of study were performed: a macro-structural study covering the whole population of the area, and following this, a survey based on a probabilistic sample of the population in the same area.

The aim of the macro-structural study was to acquire as complete as possible a knowledge of the dynamics of the population, its socioeconomic structure, and the area's social institutions from its foundation to the present. The three components of population dynamics considered were natality, mortality, and migration. The socioeconomic factors considered essential to the study's objectives were the area's landowning structure, product mix, and predominant types of activity; the number of persons engaged in work and the types of occupations (present and previous); the duration and type of land occupation; production values and forms of appropriation of surplus; and production techniques. The study of institutions focused

TABLE 50 Nine Contexts Defined in Terms of Modes of Production and Type of Involvement in the Development Process: Brazil

Modes of Production	Insertion in Development Process		
	Concentration	Dispersion	Interstitial
Capitalism			
Monopolistic	Sao Jose dos Campos (Sao Paulo - SP)	--	--
Competitive	Recife (Pernambuco - PE)	Sertaozinho (Sao Paulo - SP)	Cachoeiro do Itapemirim (Espirito Santo - ES)
System of Autonomous Producers			
Urban	Santa Cruz do Sul (Rio Grande do Sul - RS)	--	Parnaiba (Piaui - PI)
Rural	--	Santa Cruz do Sul (Rio Grande do Sul - RS)	Parnaiba (Piaui - PI)
Rural Servitude	--	Conceicao do Araguaia (Para - PA)	--

on their role in individual reproductive decision making. The institutions considered included the economic production unit, the family, the health care system, the educational system, religious and political institutions, and the mass media. The sources of information used were secondary: censuses (demographic, industrial, and agricultural); other specialized publications containing statistical data; historical monographs; papers on research carried out previously in the same region; direct observation with qualified informants; focused interviews with people who had lived in the region for a long time; and in-depth interviews with members of the population in general.[3]

The second stage of the NIHR consisted of a fertility survey conducted in each of the nine areas, shaped by the findings of the macro-structural study. That initial

study helped delineate the sample by revealing, for example, the production relations prevailing in the area; the rural proletariat and its spatial distribution, both in the countryside and on the urban outskirts of a municipality; the annual cycle of each region's range of major products, coupled with the rainy and dry seasons; and the seasonality of harvests requiring harvest workers. In-depth interviews among the population in general were another important aid in designing the survey. The sampling procedure proposed for the survey was three-stage equiprobability: the primary sampling unit was a census tract, the secondary unit a block, and the tertiary unit a household. Whenever possible, appropriate sampling fractions were determined to ensure that each household in a given region had the same probability of belonging to the sample.

A household was understood as a group of people linked by kinship, affinity, or economic relations and living under the same roof. Each was given a questionnaire consisting of three modules.

The first, known as the household module, contained information on all the members of the household, identifying them through their relation to the head of the household, as well as their age, sex, marital status, level of schooling, occupation (type of activity, position, and periodicity), monthly earnings, and consumption. In addition, there was information on help given to or received from other members of the group not living in the household, and on the division of labor within it. In rural areas, additional questions concerned the different arrangements for land tenure, types of harvest, number of animals, agricultural implements, and the like. During the interview, this information was given by any adult considered a qualified informant and a member of the household group.

The second module, a life history, was designed to obtain fundamental quantitative data for a study of reproduction strategies. Unlike most fertility studies, the NIHR was not limited to women between ages 15 and 49 in stable marital unions.[4] Any member of the household group was eligible for this module, as well as for the third, described below.[5] Some clarification is required concerning the inclusion of males in this survey. Although rarely carried out in practice, the need for this inclusion has been pointed to with some frequency in the literature since the husband's role in decision making within the family, his position on the use of contracep-

tives, and so on are important determinants of reproductive behavior.[6] In the NIHR, inclusion of males is justified not only for these reasons, but also for others resulting from the theoretical approach adopted: since the NIHR set out to link the forms of production to modes of reproduction, the agent most closely linked with the production process was especially important. One individual was selected at random from each household for application of the life history module and referred to thereafter as the Ego. The Ego's life history was followed from birth to the present. Information was gathered on migration, education, and occupation, as well as on the composition of and changes in the Ego's family group. The module also contained a detailed reproductive history, beginning with the menarche (for women) or earliest sexual relation (for men) and continuing up to the menopause or andropause, respectively, with information gathered on unions, duration and result of pregnancies, use of contraceptives, breastfeeding, surviving children, dates of death of nonsurvivors, and so on. If the Ego then had previous or current marital unions, the life history of the spouse was gathered in equal detail from the beginning of the union. Information given by Ego was also used to reconstruct, in less detail, the spouse's life history at three points prior to the union--at birth, age 10, and age 18.

Finally, the third module, also answered by the Ego, was aimed at obtaining transversal material to explain a number of actual practices involving the relationship between institutions and reproductive behavior. These included the existence of distinct plans or strategies regarding reproduction, help given to and received from children, and the like.

In conclusion, it should be emphasized that the NIHR was not intended as a representative national sample. Its samples are representative only in relation to the area or municipality from which they were selected. Given the characteristics of the study, it would be practically meaningless to aggregate the nine contexts to provide estimates of national-level demographic parameters. Thus the discussion that follows, while parallel to that of Part I in many ways, is quite different in focus, and serves as a complement to that analysis.

CHAPTER 6

THE TOTAL FERTILITY RATE: LEVELS AND TRENDS

Before proceeding with an analysis of the total fertility rate based on NIHR data, it is worth clarifying some points with regard to these data. The NIHR surveys were performed with the aim of covering 400 households in each area except Sao Jose dos Campos and Recife, where 800 households per area were included. As mentioned above, the information unit was any adult. However, for purposes of the following analysis, the unit will be taken as a woman, and some comments should be made in this connection.

First, it is worth noting that the information on a woman's reproductive history (contained in the life-history module) was given by the woman when she was the selected adult, or by her mate when he was selected, whether his wife was alive or not. Thus, the samples do not refer only to cohorts of women who survived until the survey, and it is not necessary to make the usual assumption that the fertility experience of women who did not survive is faithfully represented by the experience of those who did. With this in mind, whenever the reproductive history of an adult is considered, the woman may have been in any one of the following situations:

1. alive and single
2. alive and married
3. alive and separated
4. alive and widowed
5. dead and married while alive

Situations 1, 3, and 4 could only occur if the woman was the informant; situation 5 could only occur if a man was the informant; and situation 2 could occur in either case.

Second, the fact that the investigation also included single women avoided the problem of completeness involved

in leaving out all childbearing experienced by women who declared they were single at the time of the survey. At the same time, it meant that, in general, the premarital experience of women ever married at the time of the survey was not eliminated.

Third, it should be stressed that in this investigation there was no cut-off age for asking questions on fertility history. Thus the data were not truncated, as usually happens when histories are not obtained for women over age 50. This means that fertility rates could be calculated for almost all age groups and for a distant past, although it must be remembered that memory problems may introduce certain difficulties.

The total fertility rates (Table 51) were established for three different points in time: 1965, 1970, and 1975. For each of these periods, the rates were calculated on the basis of the total number of women alive at that time, regardless of marital status. Thus if a woman was alive, for instance, in 1965, she was not necessarily alive in 1970 or after. Moreover, when the informant (Ego) was a husband separated from his wife during the year for which the fertility rate was calculated, this case was eliminated, since there was no way of knowing that woman's situation with regard to the number of children between the year of separation and the year of reference for calculating fertility. A further clarification is required concerning the dates of the surveys. For seven out of the nine areas, the surveys were conducted in 1976 or 1977; thus, the data for births in 1975 present no problems as to the calendar year. However, in Sao Jose dos Campos, the survey was performed from May to December 1975, and in Santa Cruz do Sul-Urban from November 1975 to July 1976. A correction was thus necessary for these two areas since the women in both were not exposed for the whole year. For Sao Jose dos Campos, the number of births in 1975 was multiplied by the factor 1.530, and for Santa Cruz do Sul-Urban by 1.045.

The first observation to be made when analyzing Table 51 is that there is some consistency between these results and those of Table 2 from Part I of this report. Indeed, the 1970 rate for Sao Jose (4.83) was consistent with that for Sao Paulo State (4.07), especially given that more than 70 percent of the latter's population was urban in 1970. Similarly, for Parnaiba-Rural, Parnaiba-Urban, and Recife, located in Northeast Brazil, total fertility as reported in Table 51 varied from 8.42 to 5.45 in 1970; the Table 2 value for the Northeast (7.58) is within this

TABLE 51 Total Fertility Rates, Nine Contexts, 1965, 1970, and 1975: Brazil

Context	Total Fertility Rate			Percent Decline		
	1965	1970	1975	1970/1965	1975/1970	1975/1965
Parnaiba-Rural	8.42 (221)	7.92 (253)	8.89 (258)	5.94	+12.25	+5.58
Sao Jose dos Campos	5.83 (413)	4.83 (534)	4.03 (592)	17.20	16.56	30.87
Recife	5.45 (405)	5.38 (509)	4.90 (571)	1.28	8.92	10.09
Conceicao do Araguaia	7.18 (204)	7.26 (273)	6.46 (319)	+1.11	11.02	10.03
Parnaiba-Urban	8.21 (221)	7.76 (272)	6.09 (289)	5.48	21.52	25.82
Sertaozinho	5.74 (224)	5.67 (249)	3.68 (275)	1.22	35.10	35.89
Cachoeiro	4.68 (208)	3.48 (261)	2.97 (302)	25.64	14.66	36.54
Santa Cruz-Rural	7.28 (221)	6.07 (273)	4.52 (278)	16.62	25.53	37.91
Santa Cruz-Urban	4.35 (243)	2.54 (271)	2.92 (277)	41.61	+14.96	32.87

Note: Numbers in parentheses are number of women.

range. It should also be noted that in 1970, 58 percent of the northeastern population lived in rural areas. Finally, for Conceicao do Araguaia, a frontier area, Table 51 shows a total fertility rate of 7.26 for the same period; this is very similar to the Table 2 rate for Frontier States of 7.08.

There was a very large variation in fertility from one context to another, and this variation increased over time. In 1965, the maximum variability was about 4 children per woman, rising to 5.4 in 1970 and 6.0 in 1975. The extreme cases were always Santa Cruz do Sul-Urban, with the lowest total fertility rate, and Parnaiba-Rural, with the highest. Figure 5 (on page 37) highlights the enormous differences in fertility between these two

contexts: the reproductive pattern of Santa Cruz-Urban is more like that of a European country with low fertility, while that of Parnaiba-Rural resembles a natural-fertility pattern. A further point, which also confirms the theoretical approach of the NIHR, is that the rural contexts do not necessarily have higher fertility rates than the urban contexts.

In analyzing the trends for each context, it can be seen that from 1965 to 1970, with the exception of Conceicao do Araguaia, all areas show a decline. This decline was most marked in Santa Cruz-Urban (42 percent), Cachoeiro (26 percent), Sao Jose dos Campos (17 percent), and Santa Cruz-Rural (17 percent); Parnaiba-Urban and -Rural had a slight decline of around 5 to 6 percent; and Recife and Sertaozinho had a fall of only 1.2 percent. For 1970 to 1975, the decline was much steeper, except for Parnaiba-Rural and Santa Cruz-Urban. However, the total fertility rate for the latter area in 1975 should be taken with reservations, since fluctuations in the sampling process made the specific fertility rate for women between 15 and 19 very high in 1975. For the same period, the percentage decline was consistently high, ranging from 9 percent to 35 percent; this explains the acceleration in Brazil's fertility decline of an average 24 percent. The decline in contexts located in North and Northeast Brazil--Recife, Parnaiba-Urban and -Rural, and Conceicao do Araguaia--accelerated over the 1970-75 period, rising from 9 percent to 22 percent. In 1970-75, Sao Jose dos Campos maintained the same level of decline as for 1965-70--around 17 percent. Cachoeiro showed deceleration in 1970-75 with a decline of only 15 percent, as compared to its 26 percent decline for the preceding period. For the 10 years from 1965 to 1975, it is very clear that there was a fall of over 30 percent in Sao Jose, Sertaozinho, Cachoeiro, and Santa Cruz-Urban and -Rural; Recife and Conceicaco do Araguaia maintained a fall of 10 percent; and only Parnaiba-Rural showed markedly high rates.

Another approach to changing fertility levels from 1965 to 1975 is to examine parity for women in the different contexts. Table 52 shows some of this information. To reduce the fluctuation in the sample due to the small number of cases, only average parity based on that of the 25-29 and 30-34 age brackets was calculated, with the aim of reflecting the average number of children up to 30 years of age. The drop for 1970-75 was also fairly steep--around 17 percent--for most areas, thus corroborating earlier findings.

TABLE 52 Mean Parity 1/2 ($P_{25-29} + P_{30-34}$), 1965, 1970, and 1975: Brazil

Context	1965	1970	1975	$\frac{1970_{\%}}{1965}$	$\frac{1975_{\%}}{1970}$
Santa Cruz-Urban	2.32	1.99	1.65	14.22	17.08
Santa Cruz-Rural	2.92	3.16	2.80	+8.22	11.39
Cachoeiro	2.99	2.57	2.09	14.05	18.68
Sao Jose dos Campos	3.13	3.02	2.48	3.51	17.88
Recife	3.27	3.09	2.72	5.50	11.97
Sertaozinho	3.54	3.47	2.91	1.98	16.14
Conceicao do Araguaia	3.93	4.25	4.34	+8.14	+2.12
Parnaiba-Urban	4.44	4.33	3.58	2.48	17.32
Parnaiba-Rural	4.68	4.70	4.42	+0.43	5.96

The central question posed by the data reported above is why contexts with very different social and economic structures show such similar rates of decline, while more similar contexts show such different rates. The discussion that follows explores this question by examining the role of nuptiality and marital fertility in the fertility declines observed at the local level (Chapters 7 and 8); the role of the proximate determinants (Chapter 9); and the role of socioeconomic factors, specifically family income (Chapter 10).

CHAPTER 7

NUPTIALITY

As will be seen in the next chapter, a decline in marital fertility was the primary determinant of the fertility declines noted above. This conclusion parallels that of the national-level analysis in Part I. Before analyzing marital fertility, however, it is important to examine some other determinants related to nuptiality--the type of union and the initial, mean, and final age at marriage--that can contribute to a rise or fall in fertility.

TYPE OF UNION

Distribution of Types of Union

Table 53 shows the distribution of ever-married women from the NIHR according to type of union in three periods of time--1960, 1970, and 1975. Before this table is analyzed, some points must be made about the various types of union. During the colonial and imperial periods in Brazil, marriages were performed by the Catholic Church. In 1890, however, civil marriage was legally instituted as the only valid form of marriage. Since then, those who follow some kind of religion have continued to conduct religious marriages, either exclusively or as a complement to legal marriage. Two other types of union are present in Brazilian society: consensual union and permanent union. Both of these are also known as free unions since they are not limited by any type of binding connection, civil or religious. Both consensual and permanent unions are defined as stable: in the former, the couple live in the same house; in the latter, they do not.

Comparing the nine NIHR contexts (Table 53), for a fixed time period, say 1975, there is a great difference

in the types of union, ranging from the situation in which practically all unions were legal (Santa Cruz do Sul-Urban) to the opposite extreme, in which less than 30 percent of couples legalized their unions (Parnaiba-Rural). It is also noteworthy, in the same line of thought, that in Parnaiba-Urban and -Rural, and in Conceicao do Araguaia, the category Religious Only accounted for a large number of unions; in the other contexts, free union was more common than religious union, even reaching one-third of all unions in Recife. This diversity among contexts found for 1975 can also be seen for earlier periods from at least 1960 onward, as the data in Table 53 clearly show. Indeed, in 1960 the proportion of legal unions varied from 29.9 percent in Parnaiba-Rural to 92.5 percent in Santa Cruz-Urban; between these extremes, there were intermediate figures such as 52.0 percent in Parnaiba-Urban, 63 percent in Araguaia, and 66.6 percent in Recife. What is noteworthy here, however, is that for all contexts, the main change over the 15 years analyzed consisted of a gradual decline in religious as compared with free unions. In certain contexts, this decline was smaller, as in Sao Jose and Santa Cruz-Urban; in others it was greater, as in Parnaiba-Urban and -Rural, and in Recife. In Sertaozinho, the fall in the number of religious unions was not sufficient to account for the increase found for free unions, but was partly due to a reduction in the relative weight of legal unions; the same can be said of Conceicao do Araguaia.

This relative increase in free unions as a result of a fall in either religious or legalized unions is also shown in Table 54, based on the findings of the 1960 and 1970 censuses and the 1978 PNAD (National Household Sample Survey). It should be observed that in these sources, free unions include only consensual unions; there is no explicit mention of permanent unions. From this it can be concluded that the latter have been incorporated in either the consensual or single category. Indeed, the 1970 census defined single women as follows: "those women who have not entered into any civil or religious, or civil and religious marriage, and do not live in a stable consensual union."

The data in Table 54 also lend some validity to the findings from the NIHR shown in Table 53 (which are dependent on sample fluctuations given the small number of cases): there is a great deal of similarity between the contexts (Table 53) within a particular region and the results for that same region (Table 54); in other words,

TABLE 53 Percent Distribution of Ever-Married Women, by Type of Marital Union, Nine Contexts, 1960, 1970, and 1975: Brazil

Context	Type of Union					
	Religious Only	Civil and Religious and Civil Only	Other		Total	Total Number of Women
			Permanent	Consensual		
Sao Jose dos Campos						
1960	3.2	89.9	0.4	6.4	6.8	249
1970	2.0	89.7	1.1	6.1	7.2	442
1975	1.4	89.8	2.5	6.1	8.6	557
Santa Cruz-Urban						
1960	4.1	92.5	0.0	3.5	3.5	172
1970	3.3	93.9	0.0	2.8	2.8	245
1975	2.9	92.0	0.7	4.3	5.0	276
Cachoeiro do Itapemirim						
1960	3.4	89.0	0.8	6.8	7.6	118
1970	2.1	89.7	1.5	6.7	8.2	194
1975	1.7	90.8	2.1	5.5	7.6	238
Santa Cruz-Rural						
1960	5.8	84.7	1.2	8.1	9.3	171
1970	4.8	86.3	1.8	6.3	8.1	269
1975	3.7	87.6	2.3	6.4	8.7	298

Parnaiba-Urban						
1960	39.2	52.0	4.1	4.1	8.2	169
1970	35.7	52.7	3.8	7.6	11.4	235
1975	32.8	53.3	3.4	10.4	13.8	268
Parnaiba-Rural						
1960	55.9	29.9	4.9	9.2	14.1	184
1970	55.1	28.5	4.9	11.0	16.3	263
1975	52.1	30.0	5.9	11.9	17.8	286
Sertaozinho						
1960	3.0	91.1	0.0	6.0	6.0	168
1970	2.2	90.4	1.3	6.1	7.4	230
1975	2.2	85.5	3.0	9.0	12.0	270
Conceicao do Araguaia						
1960	32.8	63.0	0.8	3.4	4.2	119
1970	35.0	55.4	0.4	8.9	9.3	234
1975	32.6	53.8	0.3	13.3	13.6	301
Recife						
1960	9.2	66.6	6.1	18.4	24.5	227
1970	6.3	68.3	8.3	16.8	25.1	363
1975	5.2	64.2	9.9	20.3	30.2	462

TABLE 54 Percent Distribution of Ever-Married Women, by Type of Marital Union, 1960, 1970, and 1978: Brazil

Context	Type of Union		
	Religious Only	Civil and Religious and Civil Only	Consensual
Brazil			
1960	20.2	73.4	6.4
1970	14.4	78.6	8.1
1978	8.1	81.2	10.7
Sao Paulo			
1960	5.1	92.1	2.8
1970	3.1	92.8	4.1
1978	1.7	90.3	8.0
Southern States			
1960	9.6	86.8	3.6
1970	6.2	89.7	4.1
1978	3.5	90.0	6.5
Minas Gerais/ Espirito Santo			
1960	17.9	78.9	3.2
1970	10.8	85.2	4.0
1978	5.0	89.0	6.0
Northeastern States			
1960	42.5	48.1	9.4
1970	33.1	57.6	9.3
1978	21.5	64.1	14.4

Source: Altmann and Wong (1981b).

Sao José dos Campos is similar to Sao Paulo, Santa Cruz do Sul to the Southern Region, and Parnaiba to the Northeastern Region. It is also noteworthy that Table 54 shows, both for the country as a whole and for the four regions, a marked increase in free unions between 1960 and 1978.

Marriage strategies can also be understood in light of the various types of union in which interviewees found themselves. Considering the nine contexts as a whole first of all, it can be seen that out of a total of 2,234 unions,[7] the great majority--88 percent--were first unions. Of these, 71 percent were legal unions, while half of the remaining 30 percent were religious and the other half free (Table 55). It is evident that, with divorce impossible in Brazil at the time, a new civil marriage was impossible, so that among second unions, permanent and consensual unions were more frequent. Thus legal unions among second unions refer to cases where the

TABLE 55 Distribution of Unions According to Order and Type: Brazil

Type of Union	1st Union		2nd Union		3rd Union		Total	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Religious Only	294	15.0	38	16.8	5	11.9	336	15.0
Civil and Religious and Civil Only	1,397	71.0	45	19.9	7	16.7	1,149	64.9
Permanent	116	5.9	39	17.3	9	21.4	164	7.3
Consensual	160	8.1	104	46.0	21	50.0	285	12.8
Total Number of Women	1,967	100.0	226	100.0	42	100.0	2,234	100.0
Total Percent of Women	88.0		10.1		1.9		100.0	

first legal union ended in widowhood, or the first religious or free union ended in separation.

It is immediately noteworthy that at the start of their married lives, 14 percent of women (or of men or of partners) preferred no binding connection, and 6 percent did not even choose the bond of living together. This type of preference is a focal point of the discussion in the present chapter. First, the chapter analyzes whether this kind of behavior is more common in more recent than in older unions. Next, it examines whether even the conventional rural/urban distinction differentiates this behavior. Finally, these issues will be elaborated by examining each context individually.

Table 56 shows the distribution of the total of 1967 first unions of ever-married women according to when the union occurred, that is, women married by 1960, between 1961 and 1970, and after 1970. As can be seen, more than half were older unions--before 1960--while 29.1 percent took place between 1961 and 1970; the rest were more recent unions. It is interesting to note that the preference for legal unions remained at the same level: about 71 percent of first unions were legal, irrespective of when they were initiated. Religious unions, however, gradually lost their relative position, falling from 18.4 percent for older unions to 7.3 percent for those initiated after 1970; there was also a concomitant rise in permanent and consensual unions, which together accounted for 21.3 percent of more recent unions. In other words, the points made in the analysis of Tables 53 and 54 are supported by using as a reference point whether the union is recent or not, that is, the different marriage cohorts.

A breakdown of the total sample from the nine contexts into urban and rural shows first that within both groups there is considerable similarity in the temporality of first unions. Indeed, 52 percent and 51 percent of women were married before 1960 in urban and rural contexts, respectively; for both contexts 29 percent were married between 1961 and 1970. On the other hand, some very interesting differences can be seen in both contexts in regard to types of unions and timing. As regards the preference for religious union as the first union, in urban contexts, this preference declined drastically over time, from 14.0 percent to 2.6 percent, a drop of 5.4 times (see Table 57); in the rural areas, the drop was only 1.8 times. For more recent rural marriages, religious unions represented about the same proportion (13.8 percent) as that for marriages that took place at least

TABLE 56 Distribution of Ever-Married Women by Type of First Union, for Three Marriage Cohorts: A (until 1960), B (1961-70), and C (1971-76), and for Nine Contexts: Brazil

	A		B		C		Total	
Type of First Union	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Religious Only	187	18.4	80	14.0	27	7.3	294	15.0
Civil and Religious, and Civil Only	273	71.1	409	71.9	265	71.4	1,397	71.0
Permanent	40	3.9	42	7.4	34	9.2	116	5.9
Consensual	67	6.6	38	6.7	45	12.1	150	8.1
Total Number of Women	1,017	100.0	569	100.0	371	100.0	1,967	100.0
Total Percent of Women	52.0		29.1		18.9		100.0	

TABLE 57 Distribution of Ever-Married Women by Type of First Union, for Three Marriage Cohorts: A (until 1960), B (1961-70), and C (1971-76), for Five Urban and Four Rural Contexts: Brazil

Type of First Union	Urban Contexts				Rural Contexts			
	A	B	C	All	A	B	C	All
Religious Only	14.0	6.0	2.6	9.6	25.2	26.6	13.8	23.4
Civil and Religious, and Civil Only	75.3	78.1	75.9	76.3	64.2	61.9	59.8	62.7
Permanent	5.1	7.7	10.0	6.8	2.0	6.7	7.2	4.4
Consensual	5.4	8.0	11.5	7.4	8.4	4.5	19.0	9.4
Total Number of Women	625	348	229	1,202	292	221	152	765
Total Percent of Women	52.0	28.9	19.1	100.0	51.2	28.9	19.9	100.0

15 years ago in urban contexts (14.0 percent). Moreover, in the rural contexts, the preference for legal unions also fell in relative terms, although less drastically. At the same time, there was a moderate rise (and a steeper one than in the urban contexts) in permanent and consensual unions as a percentage of all first unions; this reached 26.2 percent of initial preferences for more recent unions.

The next step in the analysis was to investigate how these findings operated within each context, that is, to see how the preferences for the various types of union among the total first unions developed over time. To this end, Table 58 shows the distribution of ever-married women according to the type of union, for the same three marriage cohorts. It may be noted immediately that in all contexts, there was a progressive increase in permanent and consensual unions; only Santa Cruz-Urban showed any stabilization in the proportions of permanent unions, while only in Cachoeiro did consensual unions show an increase in proportions, followed by a decrease.

In this comparison of contexts, it is highly interesting to note that in the country's poorer areas analyzed here--Parnaiba and Conceicao do Araguaia--religious unions represented a noteworthy alternative among unions occurring before 1960; indeed, they competed with legal unions in Parnaiba-Urban and overtook them in Parnaiba-Rural. A number of different reasons may explain this. First, work relations, above all in the countryside, then offered no protection in the form of social security for individuals or their families; thus no documents were required on family structure, birth of children, and so on. Another reason, somewhat related to the first, may be the fact that no property was owned that could be divided for inheritance. It is also worth mentioning the possible absence of civil registries at that time in certain areas of the country, whereas churches have always been universally present. Then, too, the continuation of the custom of religious marriage, which is so deep-seated in Northeast Brazil, represented a resistance to the new relative prominence granted the Catholic Church by the Republic. Finally, religious marriage as a first union can be seen as a forerunner of legalized union.

The relative decline of religious unions in these contexts may be due to changes in all or some of these elements. One change is undeniable: access to registries became easier with improved communications. Moreover, the fact that a legalized union entitled one to social secur-

TABLE 58 Distribution of Ever-Married Women According to Type of First Union, for Three Marriage Cohorts: A (until 1960), B 1961-70), and C (1971-76), Nine Contexts: Brazil

	Cachoeiro			Santa Cruz-Urban			Sao Jose dos Campos			Sertaozinho			Santa Cruz-Rural		
First Union Type	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Religious Only	4.8	0.0	0.0	3.9	1.1	2.3	4.0	2.3	0.0	1.7	0.0	2.0	6.3	1.9	1.2
Civil and Religious and Civil Only	88.7	90.6	88.6	94.4	97.7	88.1	92.0	89.9	87.4	91.4	89.6	66.7	82.8	85.6	75.0
Permanent	0.8	2.3	8.6	0.0	0.0	0.0	1.8	5.5	8.1	1.1	3.9	3.9	1.7	8.6	14.6
Consensual	5.6	7.0	5.7	1.9	2.1	9.0	2.2	2.3	4.4	5.7	6.5	27.4	9.1	3.8	8.3
Total Number of Women	124	85	70	179	89	42	274	218	135	174	77	51	175	104	48

	Recife			Parnaiba-Urban			Conceicao do Araguaia			Parnaiba-Rural		
First Union Type	A	B	C	A	B	C	A	B	C	A	B	C
Religious Only	11.4	3.3	2.0	45.5	35.0	18.7	31.8	40.3	22.3	59.4	58.7	23.2
Civil and Religious and Civil Only	66.1	67.0	55.8	46.6	50.0	64.6	61.4	51.3	53.2	26.1	23.9	50.0
Permanent	8.6	13.7	18.4	4.8	7.5	8.3	0.7	0.8	2.1	5.8	8.7	8.9
Consensual	13.9	15.9	23.8	3.2	7.5	8.3	6.1	7.6	22.3	8.7	8.7	17.8
Total Number of Women	280	182	147	189	80	48	132	119	94	207	92	56

ity certainly represented a stimulus. For example, in Parnaiba, the Social Security Office performs a most important role in the life of wage-earners (Loyola, 1978), many of whom are laid off for sickness due to nervous exhaustion. They then register with the Social Security Office and, as they themselves put it, "stay on the shelf" for months or even years receiving benefits. A new supply of labor is therefore recruited to replace those laid off. When some of these fresh workers are in turn laid off sick, some who have previously been laid off are reemployed, and so on. Thus, each family group always has the possibility of one of its members being either laid off and receiving a portion of his or her wage from the government, or employed and receiving the full wage. Although this situation may seem strange, it represents an attempt to overcome the problem of poverty in the region, or to "redistribute poverty."

At the other extreme low proportions of religious unions are observed in most contexts, except unions initiated before 1960 in Recife, where this type of union still represented 11 percent of the total (Table 58). In Cachoeiro and Sao Jose dos Campos, this proportion was already low, falling to zero for more recent unions.

As for legal unions, Cachoeiro practically maintained a stable pattern (around 90 percent); Santa Cruz-Urban and -Rural, which accounted for the highest level of legal unions, saw an increase of this type of union from the first to the second cohort, mainly because of a drop in the relative importance of religious unions. In these two contexts, the decline in the relative weight of legal unions among more recent unions can be explained directly by an increase in free unions. It should be remembered that Santa Cruz do Sul is made up largely of European immigrants, mostly of German origin, who developed family-based agricultural activities and later specialized in tobacco growing. This led the urban part of the municipality to develop an industrial complex based on the processing of tobacco. The prominance of legal unions can be linked not only to cultural factors, but also to issues of property ownership and inheritance. One possible explanation of any decline in the proportion of legal unions may therefore be removal of the latter stimulus by the breaking up of these properties, already small, over the years. In Sao Jose dos Campos, where much of the working population is employed on a wage-earning basis by large and medium-sized companies, it could only be expected that legalized unions would account for a high percentage of the total number of unions.

The Role of Consensual Unions

To understand Brazilian marriage strategies, it is essential to examine the role of consensual unions more closely. Consensual union may be an option for living together when there is no stimulus for legalized union, as discussed above. To this reason should be added the far from negligible cost of a civil marriage.[8] In Parnaiba, for example, one can clearly observe the phenomenon of "marriage by seduction" (Loyola, 1978) as a strategy to avoid spending money on a civil, or even a religious, marriage. This represents a method used by women--above all those from the poorer groups within the population--to guarantee a union in a context where the male-female ratio in the 15-49 age group was only 84:100 in 1960 and 1970. Once the girl had been "seduced," her family summoned the "seducer" and demanded that he remain with the girl "to correct his error," but without a dowry or any wedding feasts or ceremonies, as a pseudo-punishment.

Consensual unions are also a solution to separations following legal or even religious unions. Indeed, up until 1978,[9] dissolutions of legal unions, even when formalized before a judge (desquite), made new civil unions impossible. The Catholic Church also does not permit a second religious union, since this bond is indissoluble according to the law of God. Thus, the only way to marry again was through a free union.

Consensual union may also result from a change in values that sees legal bonds as unnecessary. This may be especially important among the younger groups of the population, as part of a general questioning of traditional norms and values. Women's liberation has made women both more economically independent and more disposed to express their sexuality, again leading to a preference for free unions.

The preference for consensual union may reflect a definitive decision, or it may represent a preliminary stage in conjugal life prior to a legal and/or religious union. It is also probable that pregnancy may contribute to legalization in large Brazilian metropolises. However, the size of the cities included in the NIHR, such as Recife and Sao Jose dos Campos, together with the time covered by the survey (which stopped at 1977), made it impossible to support this conclusion empirically.

The issue raised here can be clarified by a brief analysis of consensual unions for each of the nine contexts. To this end, the following classification has been developed:

(1) consensual union as the only union
(2) consensual union following a legal union
(3) consensual union following a religious union
(4) consensual union prior to a legal union
(5) consensual union prior to a religious or permanent union

The study was made based on the three above-mentioned marriage cohorts, with results as shown in Table 59.

It should be noted at the start that the small number of cases for each context, except Recife, permits a merely illustrative analysis of each situation. It must also be remembered that marriage strategies are a dynamic process; thus a woman living in a consensual union at a given moment has a certain probability of legalizing it or of entering a religious union at any subsequent moment.

Sao Jose dos Campos is one context where the great majority of consensual unions represented a second or third union following a civil marriage. It thus illustrates situations (2) and (3). Out of the total of 42 cases, 16 occurred before 1960, a further 16 between 1961 and 1970, and the remaining 10 after 1970. For older consensual unions, 68.7 percent occurred as the only marriage solution after a legal union. This proportion fell to 56.3 percent for the following cohort, while for more recent unions it was 60.0 percent. The 6 cases out of 42 in which consensual union preceded a civil union took place before 1971. Of these, 3 cases involved the legalization of a consensual union, with 2 cases taking place after the birth of a child; in the other 3 cases, the legal union was with a different person. Situation (1) represented 9 cases, or 21.4 percent of the total; these 9 cases were equally distributed over the three marriage cohorts.

Parnaiba-Rural illustrates a certain balance between the types of consensual unions, with the greatest incidence for situations (4) and (5) (34.5 percent). As noted above, religious union has always been highly valued in this region, one of Brazil's poorest. Thus there were 6 cases in which a consensual union preceded a legal union and 13 in which it preceded a religious union. Of these 6 former cases, 5 were unions legalized with the same person, with 3 of these occurring after the birth of children. Of the 13 cases where religious unions followed consensual unions, 50 percent were with the same person, with the bearing of children an associated factor. In Parnaiba-Rural, it is also worth noting that 21 of the 55

TABLE 59 Distribution of Consensual Unions by Different Types, Nine Contexts: Brazil

Contexts	Consensual Union			Total Number of Women
	Only Type of Union C_1	Before a Legal and/or Religious Union C_2	After a Legal and/or Religious Union C_3	
Sao Jose dos Campos	21.4	16.7	61.9	42
Parnaiba-Rural	30.9	34.5	34.6	55
Parnaiba-Urban	39.4	24.3	36.3	33
Conceicao do Araguaia	45.6	11.1	26.7	45
Recife	50.0	19.8	30.1	146
Santa Cruz-Urban	58.3	0.0	41.7	12
Sertaozinho	75.0	6.3	18.7	32
Santa Cruz-Rural	80.8	11.6	7.6	26
Cachoeiro do Itapemirim	82.3	0.0	17.7	17

consensual unions began before 1961, meaning that they had already lasted at least 16 years; only 3 of these had occurred following a legal and/or religious union.

The picture presented by Parnaiba-Urban is to some extent parallel. Of the consensual unions prior to another union (24.3 percent), 6 cases preceded legal unions and only 2 preceded religious unions. Of the 6 former cases, 5 were with the same person, with legalization occurring after the birth of one or more children.

Santa Cruz-Rural and Sertaozinho were the contexts that showed the highest proportions of consensual unions as the only union (situation (1)); in both contexts, most of these unions occurred before 1961. Consensual union as a strategy preceding another type of union (situations (4) and (5)) was most infrequent. It was also infrequent as a solution following a separation, perhaps because the separation rates in these two rural contexts were among the lowest for the whole NIHR (12.4 percent and 18.5 percent, respectively for Santa Cruz and Sertaozinho, as compared, for example, with 34.4 percent and 39.5 percent, respectively, for Parnaiba-Rural and Recife). In Sertaozinho, there were 2 cases in which consensual union preceded a legal union, with legalization associated with the birth of a child; in Santa Cruz-Rural, there were 2 such cases.

However small the number of consensual unions in Santa Cruz-Urban and Cachoeiro, where the numerical results were subject to considerable sample fluctuation, it should be noted that these contexts showed a very similar absence of consensual unions as a stage prior to a legal union. This may simply indicate that not enough time had passed for these unions to be converted into legal marriages since, as seen above, religious unions were extremely rare in these two urban contexts. However, from the data for Cachoeiro, it can be seen that of the 14 consensual unions as only unions, 7 had already occurred by 1961, while the other 7 had occurred during the past 15 or 16 years. Thus, this is not a recent practice. The situation was analogous in Santa Cruz, where for 7 cases, 3 were older and 4 had occurred over the preceding 15 years.

The context with the highest number of consensual unions was Recife, which represents 36 percent of the total for these unions. Table 60 shows how the different consensual situations were distributed in Recife for three distinct marriage cohorts. These figures show that the first two marriage cohorts behaved in a very similar way: consensual union as the only union had a greater weight,

TABLE 60 Distribution of Consensual Unions, by Type for Three Marriage Cohorts, Recife: Brazil

Consensual Union	Marriage Cohort A	B	C
Only Type of Union	44.2	42.5	61.1
Before a Legal and/or Religious Union	28.9	27.5	5.6
After a Legal and/or Religious Union	26.8	30.0	33.3
Total Number of Women	52	40	54

from 42 percent to 44 percent, while the remaining 60 percent was equally divided between the other two situations. In other words, almost 30 percent of consensual unions preceded a legal and/or religious union. For the more recent cohort, the situation is the same as regards consensual union after a nonfree union. It can therefore be seen that around 30 percent of consensual unions, irrespective of the marriage cohort, represented a solution to the problem of separation. As for consensual union preceding a nonfree union, this percentage fell considerably for the last cohort, with a resulting rise in the percentage of consensual unions as only union. This suggests that there had not been enough time for a consensual union initiated between 1971 and 1977 to be transformed into a legal and/or religious marriage. Examining the 17 cases of consensual unions preceding a legal union for the three cohorts, it can be seen that in 8 cases, legalization occurred with the same person and following the birth of a child; in 2 cases, legalization was not associated with the birth of a child.

Type of Union and Fertility

The mean number of children born in consensual unions, while lower in most instances than the means for religious

and legal unions, is still significant in all nine contexts, as can be clearly seen from the data in Table 61. Except for Cachoeiro de Itapemirim and Santa Cruz do Sul-Urban, the mean number of children born per woman was greatest for women in religious only unions, followed by those in legal unions, and, lowest of all, those in consensual unions. Unfortunately, the small size of the samples makes it impossible to break down each type of union by its duration.

For this reason, although a central point of this report is variation among the contexts, it is useful to combine them in order to increase the sample size and be able to control for the duration of the union, which enhanced the study of the influence on fertility of the type of union. Table 62 shows the mean number of children for those women who had had only one union and were still married at the time of the interview. This group was chosen to avoid the problems raised by combining all the children born of different unions that might have occurred within the same period. As can be seen, there is a clear decline in the mean number of children from only religious to permanent unions for the first two marriage cohorts.

TABLE 61 Mean Number of Children Ever Born Alive by Ever-Married Women, by Type of Marital Union, Nine Contexts, 1975: Brazil

	Type of Union		
Context	Religious Only	Civil and Religious and Civil Only	Consensual
Cachoeiro de Itapemirim	2.2	3.1	3.2
Santa Cruz do Sul-Urban	3.5	2.5	3.5
Sao Jose dos Campos	4.2	3.4	1.2
Sertao Zinho	5.8	4.3	2.6
Santa Cruz do Sul-Rural	5.8	3.9	2.3
Recife	4.4	3.5	2.1
Parnaiba-Urban	5.6	5.3	3.1
Conceicao do Araguaia-Rural	4.1	3.9	2.3
Parnaiba-Rural	6.0	5.3	2.7

TABLE 62 Mean Number of Children Ever Born, for Currently Married Women (first marriage), by Type of Union and Three Marriage Cohorts, Nine Contexts: Brazil

Types of Union	Marriage Cohorts						
	Until 1960 A		From 1961-70 B		From 1971 on C		All Cohorts
Religious Only	4.6	(181)	4.4	(128)	1.9	(46)	4.2
Civil and Religious and Civil Only	4.3	(922)	3.2	(708)	1.5	(464)	3.3
Consensual	3.9	(46)	2.9	(47)	1.6	(79)	2.5
Permanent	3.4	(32)	2.7	(40)	1.6	(45)	2.5

Note: Numbers in parentheses are number of women.

However, the difference between the fertility of women who had only religious unions and those who had civil and/or religious unions tended to increase considerably for unions between 1961 and 1970. It should be noted that any conclusion about the most recent marriage cohort must be regarded with caution since this period covers 6 years at the most, and may thus include unions that lasted a very short time; in this period, a difference of, say, one year makes a considerable difference as regards fertility.

AGE AT MARRIAGE

It is valuable for the study of nuptiality and fertility to estimate some nuptiality parameters, such as initial, mean, and final age at marriage. The information used for this purpose concerns the proportion of nonsingle women and the average parity per age bracket for 1965, 1970, and 1975. The method used to adjust nuptiality patterns to the empirical data was that suggested by Coale (1971), with r_2 defined as the ratio of nonsingle women aged 15-20 to those 20-25, and r_3 the ratio of nonsingle women aged 20-25 to those 30-35. Initial age at marriage was confined to the 10-14 age bracket. The small number of cases in each context once again made it difficult to interpret the results, as shown by the data in Table 63. Indeed, these estimates fluctuate considerably from one period to another within a single context, thus restrict-

TABLE 63 Estimates for Nuptiality Parameters Using Coale's Method, Nine Contexts: Brazil

Context	Initial Age at Marriage			Mean Age at Marriage			Final Age at Marriage		
	1965	1970	1975	1965	1970	1975	1965	1970	1975
Sao Jose dos Campos	13.91	11.83	14.90	18.97	21.27	23.50	31.71	45.05	45.19
Santa Cruz do Sul-Urban	13.26	11.85	12.59	23.33	23.96	21.96	48.72	54.16	45.58
Santa Cruz do Sul-Rural	--	10.85	11.90	--	20.28	21.43	--	44.05	45.45
Parnaiba-Urban	12.04	10.92	13.62	19.68	19.10	18.48	38.96	39.71	30.72
Parnaiba-Rural	--	10.00	12.69	--	19.54	18.10	--	43.60	46.46
Sertaozinho	--	--	10.18	--	--	18.53	--	--	39.50
Conceicao do Araguaia	--	--	13.73	--	--	18.99	--	--	32.25
Cachoeiro do Itapemirim	13.83	14.35	11.69	21.46	19.49	20.32	40.71	32.44	42.05
Recife	--	12.99	12.78	--	19.86	23.44	--	37.15	50.32

Note: -- indicates sample size too small to calculate.

ing any analysis of trends. This effect of fluctuations in the samples is reduced by working with data for all the women in the household rather than just one woman per household, as has been the case until now in this discussion. In fact, this leads to a substantial increase in the size of the samples for each context; unfortunately, however, it is only feasible for the year of the investigation, for which information on all members of the household is available. Table 64 shows mean age at marriage calculated by Hajnal's method (1953), on the basis of information about single women in the households by age bracket. As can be seen, the findings for 1975-77 are generally very similar to those for the various regions of Brazil (see Table 7) in 1976; this suggests that the quality of the data is acceptable and that the fluctuations observed in Table 57 were in fact due to the small number of cases. Moreover, the effect of migration must also be present as a disturbing element in this type of analysis. All the contexts were indeed subject to migratory influxes of varying intensity and duration, affecting the contingents of men and women apt to marry.[10]

With these reservations in mind, it can be seen that the highest initial age at marriage in 1975 was found in Sao Jose dos Campos (14.9 years) and the lowest in Sertao-

TABLE 64 Mean Age at Marriage (Hajnal method), Nine Contexts: Brazil

Context	Mean Age at Marriage
Sao Jose dos Campos	23.74
Santa Cruz do Sul-Urban	25.22
Santa Cruz do Sul-Rural	23.37
Parnaiba-Urban	23.39
Parnaiba-Rural	23.47
Sertaozinho	23.42
Conceicao do Araguaia	19.64
Cachoeiro de Itapemirim	23.95
Recife	23.26

zinho (10.2 years). These extremes seem consistent with the mean for Brazil in 1976, estimated by Altmann and Wong (1981b), at 13.3 years. For the Northeastern region, the age found was 12.7 years, very close to the values for Recife (12.8) and Parnaiba-Rural (12.7). For 1970-75, even taking all the above reservations into account, it can be seen that, in general, there was a certain increase in the initial age at marriage. As regards the final age at marriage, an important index of nuptiality and closely related to the "marriage market," the larger urban centers and metropolises were the regions that most favored late marriage; this applies to Recife, Sao Jose dos Campos, and Santa Cruz do Sul-Urban, contexts in which final ages were highest in 1975. With some exceptions, it can also be said that the final age at marriage generally increased between 1970 and 1976.

It should be observed, on the other hand, that the contingent of women who remain single after a given age depends, among other things, on the availability of men "exposed to the risk" of forming a union. In 1970, the sex ratio varied considerably in the 15-49 age bracket for all the areas studied. If the information at the level of municipalities from the 1970 census is used, the sex ratios per 1,000 women aged 15-49 were as follows: Sertaozinho, 1,115; Sao Jose, 1,040; Santa Cruz, 970; Cachoeiro, 960; Parnaiba, 953; Recife, 785. The proportions of women still single in the 30-39 age bracket, as shown by the data at the household level, were, in the same order, as follows: 7.4 percent, 8.8 percent, 9.1 percent, 12.3 percent, 12.5 percent, and 14.8 percent. In other words, the higher the sex ratio, the lower the proportion of still single women.

Given the reservations mentioned above, it may be concluded from this descriptive analysis that, despite the different levels in the parameters for the various contexts, initial age at marriage is rising, mean age at marriage is also increasing, and final age at marriage has also risen. What is far less clear from these data is the timing of the changes, which makes it difficult to draw firm conclusions about how they affect fertility levels. In any case, as indicated in the following chapters, the primary factor involved in Brazil's accelerated fertility decline is declining marital fertility, traceable to changing patterns of contraceptive use.

CHAPTER 8

MARITAL FERTILITY

The total fertility rates analyzed up to this point reflect the effect of unmarried women; that is, they depend on a larger or smaller proportion of still-unmarried women in the various age brackets. In the 30-39 age bracket, the figure may be as high as 15 percent. Moreover, as noted above, this proportion varies from one context to another. Marital fertility as measured by the total marital fertility rate, the topic of the present chapter, by definition avoids this effect. Table 65 shows total marital fertility rates for 1970 and 1975. In 1970, they varied from 3.70 to 9.61, and in 1975 from 2.96 to 9.64. In both cases, the lowest figure is for Santa Cruz do Sul-Urban, and the highest for Parnaiba-Urban and -Rural. As can be seen, except for Parnaiba-Rural, marital fertility declined in all contexts between 1970 and 1975. The largest decline was registered for Sertaozinho (as noted above in the comparison of total fertility rates). In those populations where birth control is not practiced, the natural marital fertility pattern after 25 years of age is shown by a convex curve that drops slowly until age 35, and then falls abruptly to reflect the steep decrease in the proportion of fertile women. On the other hand, in populations that voluntarily control fertility, the rapid decline in marital fertility rates at early ages results in greatly reduced levels of fertility at the age of 30, giving the curve a concave shape. Thus, the decline in world fertility levels involves a transition from a structural pattern represented by a convex curve to a new pattern represented by a concave curve. In Brazil, this transition can be seen in both high-fertility and low-fertility regions.

This transition can be seen from Figure 6 (see page 40) by comparing the marital fertility curves representing

TABLE 65 Total Marital Fertility Rates, Nine Contexts, 1970 and 1975: Brazil

Context	Total Marital Fertility Rate		Percent Decline
	1970	1975	$\frac{1975}{1970}$
Parnaiba-Rural	9.41 (228)	9.64 (243)	+ 2.44
Sao Jose dos Campos	6.35 (417)	5.26 (520)	17.25
Recife	7.26 (386)	6.37 (472)	12.31
Conceicao do Araguaia	8.17 (231)	7.09 (292)	13.26
Parnaiba-Urban	9.61 (231)	7.46 (245)	22.45
Sertaozinho	6.69 (223)	4.72 (248)	29.42
Cachoeiro	5.32 (197)	4.16 (250)	21.76
Santa Cruz-Rural	6.68 (225)	5.98 (245)	10.46
Santa Cruz-Urban	3.70 (218)	2.96 (234)	20.02

Note: Numbers in parentheses are number of women.

the six contexts with highest and lowest fertility levels in the NIHR. The curve for Brazil as a whole represents the middle point in the transition from a high level--as in the case of Parnaiba-Rural (with a roughly convex curve)--to a low level--as in the case of Cachoeiro de Itapemirim (with a distinctly concave curve). These differing marital fertility patterns reflect varying distances from a natural-fertility pattern. Such distances occur in a typical manner and, according to Coale, can be measured through the parameter "m," known as the degree of fertility control, or how far fertility practice has moved away from natural fertility as a result of the use of contraceptives and abortion.

The degrees of control estimated for the nine regions in 1970 and 1975 are shown in Table 66. As can be seen, in both 1970 and 1975, the greatest degrees of control were in Santa Cruz do Sul-Urban and Cachoeiro de Itapemirim; in 1975, the value for the latter was higher than for the former. The lowest levels of control were in Parnaiba-Urban and -Rural and Conceicao do Araguaia. The evolution over time of these parameters shows that there was a clear increase in fertility control for all regions.

TABLE 66 Values for the Fertility Control Measure (m) Estimated by Coale's Method, 1970 and 1975: Brazil

Context	1970	1975
Sao Jose dos Campos	0.7495	1.1792
Santa Cruz do Sul-Urban	1.9284	1.3880
Santa Cruz do Sul-Rural	0.0451	0.6624
Parnaiba-Urban	-0.2444	0.2220
Parnaiba-Rural	0.0486	0.2361
Sertaozinho	--	1.2004
Conceicao do Araguaia	--	0.1487
Cachoeiro de Itapemirim	0.6604	1.4547
Recife	0.0520	0.6721

Note: -- indicates sample size too small to calculate.

The exception was Santa Cruz do Sul-Urban, which already had fairly high levels, where the degree of control fell from 1.9 to 1.4. This decrease was probably the main factor leading to that region's increase in the total fertility rate from 2.5 to 2.9 children between 1970 and 1975.

The variations in fertility levels between 1970 and 1975 can be clarified by comparing them with the nuptiality parameters and degrees of control for the same period. In the case of Sao Jose, for example, the drop in fertility was from 4.8 to 4.0 children between 1970 and 1975; this is associated with an increase in the degree of control from 0.7 to 1.2, and with an increase in mean age at marriage and initial age at marriage from 21.2 to 23.5 and 11.83 to 14.90 years of age, respectively.

CHAPTER 9

THE PROXIMATE VARIABLES

The factors that directly influence fertility and together determine its level--the so-called proximate variables--can be grouped as follows, according to Bongaarts (1983):

a) exposure to regular sexual relations
   - proportion of married women
b) prevalence of deliberate control of marital fertility
   - use and efficiency of contraceptives
   - prevalence of induced abortion
c) determinants of natural marital fertility
   - duration of postpartum infecundity
   - fecundity
   - spontaneous intrauterine mortality
   - prevalence of permanent sterility

However, not all these factors have the same impact in determining discrepancies between natural fertility and the total fertility rates observed in a given context. In fact, the proportion of married women, the use and efficiency of contraceptives, the prevalence of induced abortion, and the duration of postpartum infecundity account in general for over 95 percent of those discrepancies; the effects of the remaining three factors are difficult to measure in such studies as fertility surveys. Postpartum infecundity depends in turn on the length of sexual abstention following delivery and on the duration of breastfeeding. In Latin America, prolonged abstinence is not as common a practice as it is in some African and Asian countries. As can be seen in Table 67, in the NIHR, a limited number of women declared they abstained. On the other hand, what does still exist among some groups of women of rural origin is "postpartum quarantine" or "re-

TABLE 67 Currently Married Women Aged 15-49 Currently Using Contraception, by Types of Methods, Nine Contexts: Brazil

Methods Used	Sao Jose dos Campos	Santa Cruz-Urban	Santa Cruz-Rural	Parnaiba-Urban	Parnaiba-Rural	Sertaozinho	Cachoeiro de Araguaia	Cachoeiro de Itapemirim	Recife
Foam/Cream/Jelly	1.8	1.7	--	3.6	2.9	1.6	4.2	3.5	9.7
Diaphragm	--	--	--	--	--	--	--	--	--
Rhythm	11.9	11.2	29.3	14.5	8.8	4.0	5.7	7.6	13.5
Coitus Interruptus	4.3	--	5.2	1.8	--	20.6	1.4	0.7	4.3
Condom	8.3	1.7	0.2	1.8	--	1.6	--	0.7	2.2
IUD	1.4	--	--	--	--	--	1.4	1.3	0.5
Pill	60.8	75.0	44.8	36.4	29.4	60.3	38.0	57.2	30.7
Sterilization	8.3	10.4	16.4	30.9	55.9	8.7	46.5	27.6	37.1
Abstention	1.4	--	2.3	5.5	2.9	3.2	1.4	0.7	0.5
Other	1.8	--	--	5.5	--	--	1.4	0.7	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Cases	278	116	133	55	34	126	71	145	186

clusion," referring to a period when diet, bodily hygiene, and sexual practices are carefully controlled. Given these complications, in this section the duration of postpartum infecundity is measured exclusively by the duration of breastfeeding.

In the terms of the Bongaarts index, described in Chapter 1, the values for the marriage rate, C_m in each of the nine NIHR contexts were the following:

Cachoeiro de Itapemirim	0.648
Santa Cruz-Urban	0.710
Sao Jose dos Campos	0.657
Sertaozinho	0.842
Santa Cruz-Rural	0.698
Recife	0.651
Parnaiba-Urban	0.766
Conceicao do Araguaia	0.777
Parnaiba-Rural	0.832

The subsections below discuss the NIHR in relation to the other three primary proximate determinants: noncontraception use (C_c), postpartum infecundability (C_i), and abortion (C_a).

CONTRACEPTIVE USE

Contraceptive Prevalence

The NIHR registered greatly varying levels of contraceptive use in the various contexts. Parnaiba-Urban and -Rural--an area which, as noted in the Appendix, has been occupied for a long time and now has a practically stagnant economy--was shown to have the lowest fertility rates consistently, and it is this area which registered the lowest proportion of contraceptive use. These proportions are far from negligible, however: indeed, of every five women in Parnaiba-Rural who were married at the time of the survey, one was using some contraceptive method. In Conceicao do Araguaia, this proportion reached almost 30 percent, while in the other contexts it was over 50 percent. If these proportions are compared with those obtained by the Contraceptive Prevalence Surveys (CPS), described in Chapter 1 of this report, there is a high degree of consistency among some of the available results. For the state of Piaui, except for the capital, the CPS showed a contraceptive use rate for 1979 of around 28.8

percent, very close to the value obtained by the NIHR for Parnaiba-Urban (27.7 percent), as shown in column 1 of Table 68. The CPS rate for Recife in 1980 was 51.5 percent using contraceptives, while the NIHR rate was 57.5 percent. Similarly, in Santa Cruz do Sul-Urban, the CPS showed 63.0 percent of married women using contraception; this value was very close to that found by Etges (1976), in 1975 for Rio Grande do Sul (64.6 percent). On the other hand, attention should be paid to the very high rates found in the NIHR for Sao Jose dos Campos (74.9 percent) and Sertaozinho (69.2 percent), when compared with the data for Sao Paulo found by Nakamura et al. (1979), in 1978 (63.4 percent for the municipality of Sao Paulo, and 58.6 percent for the rest of the state). Even when the NIHR rates were estimated as an average of age-specific use rates (column 2, Table 68), Sao Jose still had a high rate of 71.9 percent, and the rate for Sertaozinho remained unaltered. Since there is as yet no reason to suppose that these two contexts constitute special cases in the use of contraceptives as compared with other parts of Sao Paulo state, it is probable that the NIHR has overestimated the proportions of contraceptive use. For the purposes of all the following calculations, therefore, the proportions of contraceptive use for Sao Jose and Sertaozinho adopted were, respectively, 63.4 percent and 58.6 percent.

TABLE 68 Currently Married Women Aged 15-49 Currently Using Contraception, Nine Contexts: Brazil

Context	Currently Using (percent)	Average of Age-Specific Use Rates	Number of Cases
Sao Jose dos Campos	74.9	71.9	475
Santa Cruz-Urban	63.0	60.6	219
Santa Cruz-Rural	58.3	54.3	242
Parnaiba-Urban	27.7	27.7	220
Parnaiba-Rural	20.7	19.6	207
Sertaozinho	69.2	69.3	224
Conceicao do Araguaia	29.6	29.1	274
Cachoeiro do Itapemirim	69.9	64.5	229
Recife	57.5	52.0	348

The data used as a basis for calculating average age-specific use rates showed that control was differential according to age but existed for all ages. Evidently, when observing this fact by age bracket, caution should be the rule given the extremely small number of women in each bracket. To provide a more complete idea of what may be happening in the urban areas of Brazil, the information on all five urban contexts has been combined by age bracket. As was done in Chapter 8, this is a device to increase the size of the samples, for as already stressed at the outset, it is contrary to the very objective of the NIHR to aggregate situations as distinct as these. The relevant figures are thus the following:

Age	Percent Use
15-19	48.1
20-24	62.0
25-29	71.6
30-34	71.6
35-39	64.3
40-44	53.1
45-49	26.8
Mean value	56.8

In other words, 48 percent of young couples living in urban areas are already regulating fertility. The maximum use rate is in the 25-29 and 30-34 age brackets, with the proportion falling thereafter. Proceeding the same way for the rural contexts, a lower overall mean value of 45.5 percent is obtained. For the different age brackets, the rural use rates are as follows:

Age	Percent Use
15-19	30.7
20-24	50.4
25-29	55.8
30-34	53.4
35-39	46.9
40-44	44.0
45-49	37.5
Mean value	5.5

Contraceptive Methods

Table 67 shows the methods used by those women who were resorting to contraception. Such devices as the IUD and diaphragm were practically absent from all nine contexts. There were four main methods: rhythm, coitus interruptus, the pill, and female sterilization. In Santa Cruz-Urban, Cachoeiro, and Sao Jose dos Campos, 85.4 percent, 84.8 percent and 78.1 percent of women, respectively, used highly efficient methods (the pill or sterilization, with the highest proportion for the pill). In Conceicao do Araguaia and Parnaiba-Rural, 84.5 percent and 85.4 percent of women, respectively, were using the pill or tubal sterilization (with a higher proportion for the latter). The remaining five contexts showed proportions for use of these two methods ranging from 61 percent to 69 percent; in Recife, female sterilization took the place of the pill. In sum, the more traditional methods have already lost ground to more modern and efficient methods. One interesting fact is the 8.3 percent figure for use of the condom in Sao Jose dos Campos, whereas this method has practically disappeared in the other contexts; this may reflect the presence of large numbers of immigrants who had arrived in Sao Jose over the years immediately preceding the survey. Similarly, the high proportion of women using the rhythm method in Santa Cruz-Rural may be explained by the fact that most of the population is of German extraction, and thus influenced by the European tradition. The fact that vaginal methods only appeared significantly in Recife is another noteworthy point.

Although the NIHR samples were small and the proportions of women sterilized at the time of the survey were therefore subject to considerable sample fluctuations, the growth of this practice can also clearly be seen in the results of the CPS, as reported in Chapter 1. One noteworthy fact about the age distribution of married women who were sterilized at the time of the NIHR (Table 69) is that in Cachoeiro, Conceicao do Araguaia, and Parnaiba-Rural, 50 percent or more were age 34 or younger, while in Araguaia, 15 percent had not yet reached the age of 25. What is surprising in all this is the fact that female sterilization is illegal in Brazil. The Medical Code of Ethics, Chapter VI, "On Medical Responsibility," article 52, states:

TABLE 69 Age Distribution of Currently Married, Sterilized Women Aged 15-49, Nine Contexts: Brazil

Age Group	Santa Cruz-Urban	Sertaozinho	Parnaiba-Urban	Recife	Cachoeiro do Itapemirim	Conceicao do Araguaia	Santa Cruz-Rural	Parnaiba-Rural	Sao Jose dos Campos
15-19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-24	0.0	0.0	0.0	1.4	2.5	15.2	4.5	5.3	13.0
25-29	0.0	9.1	5.9	26.1	22.5	27.3	18.2	26.3	8.7
30-34	16.7	9.1	29.4	18.8	20.0	24.2	13.6	26.3	8.7
35-39	41.7	27.3	23.5	39.1	35.0	6.1	22.7	31.6	39.2
40-44	8.3	18.2	23.5	11.6	17.5	15.2	27.3	5.3	13.0
45-49	33.3	26.3	17.7	2.9	2.5	12.1	13.6	5.3	17.4
Number of Women	12	11	17	69	40	33	22	19	23

> Sterilization is condemned, but may be practised in exceptional cases, when there is a precise indication approved by two medical doctors consulted in conference.

Aside from the few cases in which a woman's health problems lead to the advisability of sterilization, the marked increase in tubal sterilization among Brazil's female population may be the result of two factors.

The first is a consequence of the misuse of caesareans over recent years; this has been stimulated by the INAMPS (National Health and Welfare Service) through higher remuneration for this kind of operation than for normal delivery. Official data show that from 1971 to 1980 in Brazil, the proportion of caesareans to total deliveries rose from 14.6 percent to 29.3 percent. The rates for Sao Paulo over the same period rose from 17.5 percent to 36.0 percent, and similar increases occurred in practically all the Brazilian states.[11] A study performed in Ribeirao Preto, Sao Paulo state, concerning standards of assistance for deliveries showed that in 1972, 1973, and 1974, 18.1 percent, 23.0 percent, and 24.1 percent of hospital deliveries, respectively, were caesareans (Boletin de la Oficina Sanitaria Panamerican, 1978). Recent data on Greater Sao Paulo and Greater Recife permit a comparison between the type of delivery of the latest and penultimate children born to mothers who gave birth over the last 8 months (Berquo, 1981). The results for Greater Recife show that 14 percent of deliveries of the penultimate child were caesareans, while the rate is 27 percent for the latest child. In addition, 11 percent of these mothers gave birth by caesarean in both cases. For greater Sao Paulo, 21 percent of deliveries were caesareans for the penultimate child and 31 percent for the latest, while 17 percent of these mothers had given birth by caesarean in both cases. It is well known that any woman who has already had two or three caesareans is a sure candidate for sterilization. The policy adopted by INAMPS has thus increased women's chances of being sterilized. Nowadays, in fact, doctors receive the same remuneration whether a delivery is normal or caesarean; nevertheless, it seems that the doctors themselves have grown accustomed to caesarean deliveries and thus continue persuading pregnant women to accept them, with a continuing effect on sterilization levels.

The second factor which may determine the marked increase in tubal sterilization is linked to the non-

official family planning programs underway in Brazil. As noted in Chapter 3, physicians in private practive have been making more frequent use of public facilities to perform sterilizations even though use is not officially promoted. If this were not so, given the legislation mentioned earlier, these results would not be occurring and affecting even very young women, as seen in the data shown here.

Bongaarts' Index of Contraception

In calculating the Bongaarts contraception index (C_c = 1 - S x E x U), described in Chapter 1, the values for "U" are already available in the second column of Table 68. Values for "E" in any given context are calculated by adding the products of the values in Table 63 and the weights which correspond to each of the methods in accordance with its efficiency:

Methods	Contraceptive Efficiency
Foam/Cream Jelly	0.87
Diaphragm	0.88
Rhythm	0.82
Condom	0.91
IUD	0.96
Pill	0.98
Sterilization	1.00
Abstention	1.00
Other	0.90

Values for "E" thus calculated are shown in Table 70. If "U", "E", and "S" are replaced in the formula for C_c by their respective values, the results obtained are as shown in Table 71.

As can be seen, the degree of control is greatest in Cachoeiro de Itapemirim, followed by Sao Jose and Santa Cruz do Sul-Urban. The lowest values of C_c are for Conceicao do Araguaia and Parnaiba-Urban and -Rural. In other words, these results confirm the findings obtained when "m" was calculated by Coale's method. The relation between the values for C_c and total fertility is also very clear: that is, the lower the value for C_c, the lower the total fertility rate.

TABLE 70 Estimates (in percent) for Use Efficiency of Contraceptives (e), for Currently Married Women, Nine Contexts: Brazil

Method	Parnaiba-Urban	Parnaiba-Rural	Sertaozinho	Conceicao do Araguaia	Cachoeiro do Itapemirim	Recife	Sao Jose dos Campos	Santa Cruz do Sul-Urban	Santa Cruz do Sul-Rural
Abstention	5.50	2.90	3.20	1.40	0.70	0.50	1.40	0.00	2.30
Sterilization	30.90	55.90	8.70	46.50	27.60	37.10	8.30	10.40	16.40
Oral	35.77	28.81	59.09	37.24	56.06	30.09	61.78	73.50	43.90
IUD	0.00	0.00	0.00	1.34	1.25	0.48	2.36	0.00	0.00
Condom	1.64	0.00	1.46	0.00	0.64	2.00	7.55	1.55	0.18
Diaphragm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Foam/jelly/cream	3.13	2.52	1.39	3.65	3.05	8.44	1.60	1.50	0.00
Rhythm	11.89	7.22	3.28	4.67	6.32	11.07	9.80	9.18	24.03
Others	6.57	0.00	18.54	1.26	1.26	4.77	4.90	0.00	4.68
Values of e	95.3	97.35	95.66	96.06	96.88	95.26	97.69	96.13	91.76

TABLE 71 Index of Contraception, Nine Contexts: Brazil

Context	Value of C_c
Cachoeiro do Itapemirim	.312
Sao Jose dos Campos	.316
Santa Cruz-Urban	.360
Sertaozinho	.381
Santa Cruz-Rural	.450
Recife	.457
Parnaiba-Urban	.710
Conceicao do Araguaia	.693
Parnaiba-Rural	.791

Postpartum Infecundability

Before the 1960s, almost no studies on breastfeeding in Brazil were carried out. Rea (1981) presents a table, reproduced here (Table 72), which gives a good idea of the Brazilian breastfeeding situation. These data show considerable variability depending on the region and living standard. The author does, however, emphasize that comparison in this case should be approached with caution since the information and/or methodologies involved are mostly heterogeneous.

As noted in Chapter 5, the phenomenon of early weaning exists in today's Brazil, as it also does in a number of other Latin American countries (Lesthaeghe et al. 1981). On the local level, a recent study conducted by UNICEF/INAM/CEBRAP (Berquo et al. 1981) in the metropolitan areas of Sao Paulo and Recife showed a very low average time for breastfeeding for mothers in both areas. Unbiased estimates of the average duration of natural breastfeeding can be made using the calculation technique known as the current status method, based on the proportions of children in each age group who were being breastfed at the time of the interview (Jain and Bongaarts, 1981). The average time for Greater Sao Paulo was 3

TABLE 72 Percent of Breastfed Children at 4 Months of Age, by Various Studies: Brazil

Location	Year	Percent	Remarks
Recife (PE)	1968	5.8	>3 months
Sao Paulo (SP)	1971	72.0	immigrants
Sao Paulo (SP)	1973	31.6	low-income
Ribeirao Preto (SP)	1974	39.3	
Salvador (BA)	1974	38.9	
Rio de Janeiro (RJ)	1974	25.0	
Pelotas (RS)	1974	16.0	
Icapara (SP)	1975	78.8	3 months, rural
Vale do Ribeira	1975	75.0	3 months, rural
Salvador (BA)	1975	45.0	>3 months
Getulina and Guaiembe (SP)	1975	89.5	Japanese extraction, 3 months
Campinas (SP)	1976	35.3	
Austin (RJ)	1977	54.0	
Paulinea (SP)	1977	40.0	
Sorocaba (SP)	1978	30.0	>3 months
Botucatu (SP)	1978/79	50.7	3 months, medical post, school
Sao Paulo (SP)	1979	41.9	low-income
Sao Mateus (SP)	1980	13.0	working-class district
Greater Sao Paulo (SP)	1981	38.0	
Greater Recife (PE)	1981	25.0	

Source: Rea (1981).

months, and for Greater Recife 2.2 months. Even considering that this study included mothers of children no more than 8 months old at the time of the interview and thus truncated the distribution with regard to higher breastfeeding times, these values are very low. Between the first and second month, 42 percent of children in Recife and 53 percent in Sao Paulo had already been weaned.

The fact that women in Recife breastfeed for less time than those in Sao Paulo had already been highlighted by Puffer and Serrano (1973) at the time of the Inter-american Study on Childhood Mortality, conducted between 1968 and 1970. This survey showed that of the children who died in their first year, the proportion breastfed for

one month was 26.8 percent and 35.5 percent for the municipalities of Recife and Sao Paulo, respectively; the proportion of breastfed children who died at ages 6-11 months or over was 1.4 percent and 4.1 percent for Recife and Sao Paulo, respectively. Although the data presented by Puffer and Serrano refer to children who had already died at the time of the study and thus to some extent underestimated the breastfeeding times, they nevertheless indicate the regional differences involved.

In 1975, working with 593 families in the Vale do Ribeira (coastal region of Sao Paulo state) having a total of 1,005 children under 5 years, Rea (1981) found 14.6, 7.4, and 5.8 months to be the mean breastfeeding times, respectively, for mothers born in the Vale region, other regions of Sao Paulo state, or other states. For the NIHR contexts, the mean breastfeeding times were as follows:[12]

Cachoeiro de Itapemirim	8.5 months
Conceicao do Araguaia	8.5 months
Sertaozinho	7.3 months
Parnaiba-Rural	6.3 months
Sao Jose dos Campos	6.0 months
Santa Cruz-Rural	5.5 months
Parnaiba-Urban	4.8 months
Santa Cruz-Urban	4.2 months
Recife	3.3 months

On the basis of these values, Bongaarts' index of postpartum infecundability (C_i) was calculated. In the NIHR survey, as usually occurs in surveys of this kind, there are no reliable data on the postpartum amenorrhea period, that is, on "i." For this reason, the model put forward by Bongaarts (1983) was used, which establishes an exponential relation between "i" and the mean duration of breastfeeding, here represented by B:

$$i = 1.753 \exp. (.1396B - 0.001872B^2).$$

If B is replaced by the values found for mean breastfeeding times, the values shown in Table 73 are obtained for "i" and C_i. Since C_i is 1 in the complete absence of lactation or of postpartum abstinence and tends toward zero as the duration of postpartum infecundity increases, it can be seen that Cachoeiro and Conceicao do Araguaia showed the highest intervals for postpartum amenorrhea, while Recife showed the lowest.

TABLE 73 Values of "i" and C_i, Nine Contexts: Brazil

Context	Value of "i" in Months	Value of C_i
Cachoeiro do Itapemirim	5.0	0.850
Conceicao do Araguaia	5.0	0.850
Sertaozinho	4.4	0.873
Parnaiba-Rural	3.9	0.892
Sao Jose dos Campos	3.8	0.897
Santa Cruz-Rural	3.6	0.906
Parnaiba-Urban	3.3	0.918
Santa Cruz-Urban	3.0	0.928
Recife	2.7	0.942

ABORTION

The information on abortion in the NIHR covers both spontaneous and deliberate abortion, for the same reasons as those alleged in the majority of surveys on human reproduction: the questionable credibility of replies to questions intended to identify the two separately when the survey itself has not been specifically designed to study abortion. With the information available, total abortion rates (TAR) were calculated (Table 74). These rates were extremely variable from one context to another. The rate for Santa Cruz-Urban was only 9.2 percent of that for Parnaiba-Rural. In Santa Cruz-Urban and -Rural, abortion was practiced little, with Cachoeiro next in frequency. Sao Jose, Sertaozinho, and Recife had much higher and very similar rates. Parnaiba had the highest rate of all, though lower for urban than for rural women. To calculate C_a, the total fertility rates were taken from Table 51 and values for "u" from Table 62. Values for C_a (Table 74) were all very high, and close to 1. Thus, although this practice is underway in Brazil and involves many thousands of women, in overall calculations of fertility control it is of secondary importance.

TABLE 74 Total Abortion Rates (TAR) and Bongaarts' Abortion Rate (C_a), Nine Contexts: Brazil

Context	TAR	C_a
Cachoeiro do Itapemirim	0.719	0.963
Santa Cruz-Urban	0.068	0.985
Sao Jose dos Campos	0.462	0.931
Sertaozinho	0.454	0.942
Santa Cruz-Rural	0.104	0.987
Recife	0.478	0.947
Parnaiba-Urban	0.617	0.953
Conceicao do Araguaia	0.263	0.983
Parnaiba-Rural	0.735	0.967

CHAPTER 10

SOCIOECONOMIC FACTORS: FAMILY INCOME

As pointed out in Chapter 5, the fertility rates observed for each of the nine NIHR contexts varied considerably. Succeeding chapters showed that, at least at this level of analysis, a variety of reproduction strategies have been adopted by the populations of the different contexts. The present chapter incorporates into the analysis the socioeconomic variables. Among these, family income appears to have distinctive importance and is the focus of the discussion that follows.

The analysis below is limited to the urban contexts since it addresses only monetary income. Families have been classified in four categories, depending on their per capita monthly income at the time of the survey (between 1975 and 1977):

(1) up to one-half the minimum wage[13]
(2) between one-half and one minimum wage
(3) between one and two times the minimum wage
(4) over twice the minimum wage

This variable has been incorporated into the analysis according to its equivalent at the particular moment of the time of interview; this precaution was taken since the information concerned was not taken from the individual life histories, but from data included in the form dealing with the domestic group. Although this disparity makes interpretation of the results somewhat problematic, the present analysis is only preliminary; later research will be able to incorporate variables from the life histories.

The distribution of families according to income (Table 75) varies considerably from one context to the next. On the one hand, Santa Cruz, Cachoeiro, and Sao Jose dos Campos are somewhat similar, showing a degree of equili-

TABLE 75 Percent Distribution of Women Aged 15 Years and Over, by Per Capita Monthly Income (in fractions of one minimum wage), Five Urban Contexts, at Time of Survey: Brazil

Context	Up to 1/2 Min. Wage	Between 1/2 and One Min. Wage	Between One and Two Times Min. Wage	Over Twice Min. Wage
Santa Cruz-Urban	21.0	30.9	24.0	24.0
Cachoeiro do Itapemirim	22.9	31.0	24.4	21.7
San Jose dos Campos	25.1	29.3	21.6	24.0
Recife	42.9	23.3	17.4	16.3
Parnaiba-Urban	70.3	16.5	5.9	7.2

brium among the four income groups, though the group between one-half and one minimum wage has a slightly greater relative weight. In the Northeast, however, this equilibrium gives way to an asymmetrical distribution with a heavy concentration in the lowest bracket. In Recife, 42.9 percent of the families sampled fell into the first income category; an even more striking picture is presented by Parnaiba, where 70.3 percent of the families sampled fell within the per capita income bracket defined as up to half the minimum wage. These data reflect the variations in economic development among the nine contexts described in the Appendix.

With regard to Recife, as pointed out in the Appendix, the city's labor force has been characterized over recent decades by intense fluctuations between employment, unemployment, odd jobs, and various kinds of urban underemployment. The evolutionary rate for hiring of employees and dismissals in the metropolitan region of Recife for the period 1978-79 gives some idea of this fluctuation: in industry, the number of workers hired fell from 170 to 166, while the number of those dismissed rose from 150 to 194; in the service branch, while there was a rise in hirings from 118 to 128, dismissals also rose, from 113 to 125 (FIDEPE, 1980). Moreover, there can be no doubt about the underpayment of the labor force as a determinant of the poverty that dominates the Northeast of Brazil; even in the metropolitan region, 24 percent of all occupied persons work 56 hours or more per week.

As will be remembered, the urban economy of Parnaiba is linked to a subsistence- or peasant-based economy centered on the large estates (latifundia), and mercantile or commodity relations have penetrated very little. The town is a collection and distribution center for products

of plant extraction. It also has a small manufacturing branch that employs a very limited number of people--around 18 percent of the local labor force in full-time employment, while most of its production is put out to domestic or self-employed workers. As regards commerce, here, too, 95 percent of active workers are self-employed. Income from these activities is too low for subsistence, and it thus becomes necessary to combine extractive, industrial, and commercial activities and handicrafts. The bottom line of Table 75 clearly reflects this picture, characterized by a small contingent of families integrated into a formal market, with the majority engaged in occasional or irregular activities.

An analysis of female fertility for each of the five urban contexts and the four income groups yields some interesting observations. Table 76 shows the average number of children born to ever-married women 15 years of age or over who, at the time of the survey, came within a given income bracket.

This table shows, first, that in all the contexts surveyed, fertility decreases as per capita monthly income rises. In Santa Cruz do Sul, it makes little difference whether a woman belongs to the first or second income bracket; the greatest decrease is for families with per capita monthly income of over one minimum wage. In Sao Jose dos Campos, virtually the same picture holds true, although the coloring is somewhat more vivid. In Recife, however, it does make a difference in the average number of children whether a woman's family has a monthly income of between one-half and one minimum wage: compared with the first bracket, the decrease in fertility is around 30 percent. Unfortunately, it was impossible to assess the evolution of fertility for all four income groups in Parnaiba because of the extremely low number of women in the two higher brackets; for the two lower groups, however, there was a drop of 24 percent in the average number of children.

Second, the table shows that, even when a given income category is kept fixed, the various contexts show different levels of fertility: Santa Cruz do Sul and Parnaiba are at one extreme of a slope, especially as regards the first bracket, while Recife, Cachoeiro do Itapemirim, and Sao Jose dos Campos, with some small discrepancies among themselves, form an intermediate group. This variation in the average number of children per woman, which reaches its peak--2.49--for the poorest families, drops in a uniform manner until it reaches 0.32 for the bracket over

TABLE 76 Average Number of Children Born to Ever-Married Women Aged 15 and Over, by Per Capita Monthly Income (in fractions of one minimum wage), Five Urban Contexts: Brazil

Urban Contexts	(1) Up to 1/2 Min. Wage	(2) Between 1/2 and 1 M. W.	(3) Between 1 and 2 Times Min. Wage	(4) Over Twice M. W.	Percentage Decrease			
					(2)/(1)	(3)/(2)	(4)/(3)	(4)/(1)
Santa Cruz do Sul	3.37	2.96	2.29	1.74	12	23	27	50
Recife	4.28	3.05	3.33	1.87	30	10	43	56
Cachoeiro	4.39	3.38	2.47	2.06	21	27	16	53
Sao Jose dos Campos	4.97	4.23	2.94	1.94	16	32	35	62
Parnaiba	5.86	4.49	--	--	24	--	--	--
Maximum Difference	2.49	1.53	1.04	0.32				

twice the minimum wage. If Parnaiba is eliminated from the comparison (since the reduction in the variation may be influenced by the fact that Parnaiba is not represented in the two higher income brackets), the maximum difference between the contexts for the four brackets would then be, respectively, 1.60, 1.27, 1.04, and 0.32. In other words, the decrease in the variation between contexts as the per capita monthly income of the families rises is a persistent trend.

This trend may well reflect, among other things, the effect of the population's degree of involvement in the formal labor market. Such involvement requires more skill, reflected, for example, in a higher level of schooling; it also exposes people to a mass of information related to health, hygiene, sex, and reproduction. In Sao Jose dos Campos, for example, a survey of the big companies, mainly the multinationals, showed that social workers within the companies present the idea of planning to employees whose productivity is falling off; this planning includes the reduction of fertility. In their study of social institutions and reproductive behavior, Loyola and Quinteiro (1982:43) make the following point:

> . . . social institutions were observed to act basically along "controlist" lines, i.e., they induce or transmit, in an explicit or diffuse manner, the pattern of the small conjugal family, whose corollary is the idea of birth control. According to the viewpoint of the institutional agents, such a reproductive pattern is associated -- again at all points of the survey in general -- to economic and social problems (poverty, cost of living, social marginality, etc.) and appears as a solution offered to such problems in the short or long term.

However, as Loyola and Quintero note further (pp. 43-45), this institutional role varies significantly from one institution and from one context to another.

> Thus, to give one example of a contextual variation, the most general references to social problems can, in a large town in the South undergoing intense industrialization and with full employment (the case of Sao Jose dos Campos at the time of the survey), be translated into other, more specific references which basically concern the disorganizing effects on the social fabric of the excessively intense pace

of industrialization and immigration; in Parnaiba or Recife, they may take on the connotation of backwardness as compared with the South, while situations of unemployment and underemployment may be seen as non-residual realities which affect the population as a whole through their pathological consequences: abandoned minors, prostitution (Parnaiba and Recife), marginality and criminality (Recife).

Finally, it should be noted that, in addition to the basic criteria used to select the NIHR urban contexts--the prevailing form of organization of production and the social division of labor--or perhaps even as a result of these criteria, the contexts have specific features that may help to explain fertility levels. Thus in 1950, Santa Cruz do Sul, a region with a large population of German origin, already had a fertility rate considered low by Brazilian standards; moreover, family size in Santa Cruz has been highly influenced by property size, which has fallen gradually over the last few decades because of the successive sharing of inheritances among surviving children.

CHAPTER 11

CONCLUSIONS

DECOMPOSITION OF GENERAL FERTILITY RATES

The contribution of changes in age structure, marital status, and marital fertility to declines in general fertility rates in 1970-75 is shown for the nine contexts in Table 77. The standardization procedure used (see United Nations, 1979), taking 1970 as the base year, shows that the three factors play specific roles in reducing fertility in the different contexts and that distinct interaction effects are also present.

As can be seen, over the period considered, the decline in the general fertility rate varied a great deal from one context to another, as has already been observed with regard to total fertility rates. The largest fall, in Sertaozinho, was around 67.43 per 1,000 (174.70-107.27). At the other extreme was Santa Cruz-Urban (90.41-83.75), with 6.65 per 1,000. Cachoeiro de Itapemirim, Sao Jose dos Campos (154.49-140.20), Recife (174.85-162.00), and Conceicao do Araguaia (236.26-225.70) showed similar declines, which varied from 11 to 15 per 1,000; Parnaiba-Urban (227.94-185.12) and Santa Cruz-Rural (190.48-149.28) had larger declines of around 40 per 1,000. The only exception was Parnaiba-Rural (250.49-273.26), with a growth of 22.27 per 1,000 between 1970 and 1975.

In all the contexts where there was a reduction in the general fertility rate, except for Santa Cruz-Urban, the decline in marital fertility was the most directly responsible factor. In Cachoeiro, Recife, Sao Jose, and Araguaia, the decline can be totally explained by the reduction in marital fertility, and would have been even larger if age structure and marital status had not contributed to the attenuation of this reduction. In Cachoeiro, Recife, and Araguaia, the contribution of marital

TABLE 77 Changes in General Fertility Rates Due to Age Structure, Marital Status, and Marital Fertility, Nine Contexts, 1970-75: Brazil

	Santa Cruz-Urban	Conceicao do Araguaia	Recife	Sao Jose dos Campos	Cachoeiro de Itapemirim	San : Cruz-Rural	Parnaiba-Urban	Sertaozinho	Parnaiba-Rural
Age structure	-5.05	7.24	9.12	11.15	2.21	13.59	10.69	-13.72	-14.67
Marital status	-2.90	13.25	11.23	8.42	6.64	-9.77	-8.08	1.52	13.78
Marital fertility	-5.36	-22.34	-25.95	-25.09	-20.85	-41.51	-34.25	-64.55	19.47
Interaction of age structure and marital state	-0.33	-3.06	-5.45	-2.58	-1.82	3.78	1.68	0.86	-5.55
Interaction of age structure and marital fertility	7.29	-5.66	-1.69	-4.88	-0.62	-7.92	-12.63	8.12	12.82
Interaction of marital status and marital fertility	-0.44	-0.57	-0.15	-1.51	-0.70	1.50	-0.44	0.34	-6.74
Interaction of age structure and marital fertility	0.01	1.46	0.46	0.20	0.65	-0.46	0.09	0.19	2.43
Total change in general fertility rate explained	-6.79	-10.98	-12.43	-14.33	-14.49	-40.79	-42.94	-67.62	21.54
Total change in general fertility rate observed	-6.65	-10.56	-12.86	-14.29	-14.47	-41.79	-42.82	-67.43	22.27

Note: Base year, 1970.

status to an increase in the general fertility rate surpassed that of the age structure of the female population; in Sao Jose, the opposite was the case.

It is interesting to note that in Parnaiba-Urban and Santa Cruz-Rural, even though, as already stressed, the major factor determining the decline was the fall in marital fertility, the change in the distribution of the female population according to marital status also contributed to the decline. The age structure of the female population, on the other hand, showed little change in the same period, thus favoring an increase in the general fertility rate.

In Sertaozinho, it was not only the fall in marital fertility, but also the change in the age structure of the population that contributed to the decline in the general fertility rate. In Santa Cruz-Urban, these two factors were almost equal in contributing to the small decline for that region.

Finally, the increase in the general fertility rate shown for Parnaiba-Rural was the result of an increase in the marital fertility rate, a more favorable distribution by marital status, and an age distribution which favored a drop in fertility.

DECOMPOSITION OF TOTAL FERTILITY

As seen above, Bongaarts' model for estimating the total fertility rate is expressed by the relation

$$TFR = 15.3 \times C_i \times C_c \times C_a \times C_m \quad (1).$$

In other words, the starting total fecundity rate of 15.3 is gradually reduced by the action of the various inhibiting factors. The first of these is postpartum infecundity, C_i, which when applied to 15.3 reduces it to the total natural marital fertility rate:

$$TNMFR = 15.3 \times C_i.$$

This in turn, when reduced through the effects of C_c and C_a, becomes the total marital fertility rate, or

$$TMFR = TNMFR \times C_c \times C_a.$$

Finally, the latter, when subjected to the effect of C_m, becomes the total fertility rate, or

$$TFR = TMFR \times C_m.$$

Table 78 shows the decomposed values for the different contexts studied. As can be seen, the values of C_i in Cachoeiro do Itapemirim and Conceicao do Araguaia caused the greatest reduction--around 15 percent--in the total fecundity rate owing to the effect of lactation. In Recife, this effect was the lowest of all--only 6 percent. The prevalence of deliberate control of marital fertility was undeniably the main factor accounting for the reduction in the natural marital fertility rate in all contexts. In Cachoeiro and Sao Jose dos Campos, this effect reached 70 percent, followed by Santa Cruz-Urban and Sertaozinho, where it was 65 percent. In Santa Cruz-Rural and Recife, it accounted for 61 percent and 57 percent, respectively, of the fall in the rate in question. The rate for Parnaiba-Rural was reduced by only 24 percent. It should be stressed that in all contexts, although in a differentiated manner, contraception was the factor directly responsible for the difference between the total natural marital and total marital fertility rates. As for the effect of the absence of marriages, it was very small in Parniaba-Rural and Sertaozinho, varying between 16 and 17 percent. In Parnaiba-Urban and Conceicao do Araguaia, this effect was about 22 percent, increasing to about 30 percent for Santa Cruz. In Sao Jose dos Campos and Recife 34 percent of the women were not yet married, and in Cachoeiro it was 35 percent, bringing the total marital fertility rate down from 3.91 to 2.53. In the other five contexts, this effect was practically uniform--between 21 percent and 24 percent.

FINDINGS AT THE NATIONAL/STATE AND LOCAL LEVELS

When the findings in Parts I and II of this report are compared, they are found to be complementary and mutually supportive. Both data sets clearly show an accelerated fertility decline in Brazil during the 1970s. Both indicate the importance of consensual unions in Brazilian nuptiality patterns, as well as the difficulties involved in gathering data on these unions; they also point to shifts in age at marriage. However, the national- and local-level analyses lead to the same conclusion: that the primary factor responsible for Brazil's accelerated fertility decline is declining marital fertility. This decline can in turn be traced, at both levels of analysis,

TABLE 78 Proximate Determinants of Total Fertility, Nine Contexts, 1975: Brazil

Measure	Cachoeiro do Itapemirim	Santa Cruz-Urban	Sao Jose dos Campos	Sertaozinho	Santa Cruz-Rural	Recife	Parnaiba-Urban	Conceicao do Araguaia	Parnaiba-Rural
Total Fecundity Rate	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
Postpartum Infecundity, C_i	0.950	0.928	0.897	0.873	0.906	0.942	0.918	0.850	0.892
Total Natural Marital Fertility Rate	13.0	14.2	13.7	13.4	13.9	14.4	14.0	13.0	13.6
Abortion, C_a	0.963	0.985	0.931	0.942	0.987	0.947	0.953	0.983	0.967
Contraception, C_c	0.312	0.360	0.316	0.381	0.450	0.457	0.710	0.693	0.791
Total Marital Fertility Rate	3.91	5.04	4.03	4.80	5.44	6.23	9.47	8.86	10.40
Nonmarriage, C_m	0.648	0.710	0.657	0.842	0.698	0.651	0.766	0.777	0.832
Total Fertility Rate (estimated)	2.53	3.58	2.65	4.04	3.80	4.06	7.25	6.88	8.65

to changing patterns of contraceptive use: increased prevalence, coupled with the use of more effective methods (the pill and sterilization). Among the other proximate determinants of marital fertility, postpartum infecundability has relatively little impact in Brazil, where the practice of breastfeeding is quite limited; abortion, shown in both data sets to be increasing, is nevertheless an indeterminate factor because of the usual data-gathering problems. Finally, both analyses point to a combination of factors--changes in relative income, increased educational attainment, and increased female labor force participation--as the main socioeconomic determinant of Brazil's changing patterns of contraceptive use: these factors are associated with increased desires for consumer durables, the diffusion of information on family-size limitation, and therefore an increase in conscious fertility control.

NOTES

1 The relationship between income and fertility levels is examined for the nine NIHR local contexts in Part II of this report.

2 For a further discussion of the typology used, see the Appendix. See also Lopes, (1975), Faria (1975), and Singer (1975).

3 These case studies, which have already been conducted in the nine areas, can be found in the series Estudos de Populacao, CEBRAP, 1975-81, Sao Paulo.

4 The justification for eliminating the usual age limits can be found in Berquo (1973).

5 When a member of the household group had any kind of marital union, previously or currently, and was under 18, he or she was also considered a candidate for sampling.

6 See internal document prepared for the Project by Patarra (1976).

7 Considering up to three as the maximum number of unions, since a negligible fraction surpassed that number.

8 Until November 1981, when the legal minimum wage was 8,464 cruzeiros in Sao Paulo state, the cost of a civil marriage was 1,650 cruzeiros; in Pernambuco (Northeast), these figures were 7,128 and 1,500 cruzeiros, respectively.

9 Divorce was made legal in 1978, and with it came the possibility of new legal unions.

10 CEBRAP is at present conducting a study of the migrations affecting the NIHR.

11 On this subject, see Brazil (1971-1980).

12 These values refer to a subsample of about 100 women from each context who had at least one child born alive in the last 5 years.

13 Legal minimum wage limits in force at the time of the survey: Santa Cruz-Urban, $603.60 cruzerios; Sao Jose dos Campos, $532.80 cruzerios; Cachoeiro do Itapemirim, $655.20 cruzerios; Parnaiba-Urban, $544.80 cruzerios; Recife, $602.40 cruzerios.

APPENDIX

THE NIHR CONTEXTS

PARNAIBA*

From the nineteenth century onward, Parnaiba was the main commercial entrepot for imports and exports in a primary-exporting economy (initially based on meat, and later on extractive products). Not only has it undergone the fluctuations and, finally, decline that are inherent in such economies, but it has also in recent decades been edged out of the main transportation and trading system by the increasing dominance of road over river and sea transportation. Beginning in the 1950s, this twofold process led to a major change in the region's economy, which entered a phase of stagnation. Nevertheless, the municipality retains the character of an extremely simple primary-exporting model, rooted in a peasantry that is practically unaffected by mercantile relations.

The 1970 data for the rural zone of Parnaiba depict a landowning structure in which the large estates, or latifundios, are of little commercial importance but are linked to a broadly based peasant agriculture.

The importance of peasant activities in this municipality is reflected in its agrarian structure, which can be seen in the distribution of land. In 1970, more than 80 percent of establishments (those under 5 hectares) occupied less than 5 percent of the area exploited by tenants and sharecroppers. Less than 1 percent (22

*Summarized by Maria Lucia Indjaian, from a text by Maria Andrea Loyola based on papers by Lopes and Brandt (1978).

establishments with over 50 hectares) represented almost half the total area.

Half the value of agricultural and livestock-breeding activities is attributable to farming and characteristically commercial activities, just under one-third to animal husbandry, and 12 percent to products of plant extraction. Cultivated areas are small on average, with four basic products (rice, beans, cassava, and corn) representing 82 percent of the municipality's agricultural production. The main commercial products are carnauba wax and cattle. A few establishments report some permanent crop production of a more commercial nature (banana, coconut, cashew, and mango), representing 8 percent of the overall value of agricultural production. Rice is the only widespread commercial commodity whose production can be characterized as peasant; its cultivation is aimed at obtaining a monetary supplement, and is in this way equivalent to the sale of leftovers from the grower's own consumption, seasonal employment, or craft activities.

The most widespread labor relation in the area is sharecropping. Ground rent varies depending on whether the land is handed over to the farmer already prepared for planting, and whether the owner supplies the seed; it may consist of a half, a third, or a quarter share of production. The most common case is payment of the ground rent alone in the form of a quarter share; this kind of tenant, known as a rendeiro, often does not live on the land in question, which is usually let to him for 2 years. He depends in many ways on the landowner, who represents the only channel for obtaining bank credit and even supplies of foodstuffs. The sale of products grown on the land will also depend on the landowner since they are often sold "on paper," that is, as a future harvest. Although this dependence may vary in degree, it restricts the alternatives of the great majority who possess neither land nor the conditions to acquire it. Another kind of tenant, the agregado*, usually lives on the estate and has the owner's permission to cultivate a small plot. In return, he provides payment in the form of services, which may or may not be of an economic nature.

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*Agregado: a term usually applied to one who lives on a large estate and has the owner's permission to cultivate a small plot in return for payment in the form of services (which may or may not be economic in nature).

Parnaiba's urban economy is closely tied to this peasant economy. As in the past, the main roots of the urban economy are in the commercialization of extractive products. Of these, the most important is (and has been since the beginning of the century) carnauba wax, practically 100 percent of which is exported. In 1970, the value of foreign exports, consisting of carnauba wax and jaborandi, represented 90 percent of the total economic output. The babassu nut is distributed to the domestic market. At the present time, while the town acts as a reception center for products of plant extraction, it also contains a modest manufacturing sector. It remains a service center and a pole of demographic attraction. Its medical facilities are used by other municipalities 100 km away or more (some even in neighboring Maranhao and Ceara), while its commercial establishments often serve more distant townships. Despite the weakening of its economy, the town continues to be the focus of ongoing rural-urban migration, and over the last decade, its growth has increased. However, this is probably attributable more to the stagnation of the rural economy than to any dynamism in urban activities. In 1970, the urban area contained 60.87 percent of the population; 25 percent of this population was not native to the municipality, having migrated mainly from Ceara (42.25 percent) and Maranhao (28.60 percent).

The 1970 Demographic Census showed that 35.1 percent of occupied persons worked in the secondary sector and 62.4 percent in the tertiary. The 1970 Industrial Census reported the existence of 114 industrial establishments, which absorbed 589 persons. If this number is subtracted from the total of 3,237 persons habitually occupied in manufacturing activities according to the Demographic Census, that leaves 2,648 persons involved in occasional or irregular activities. This would seem to represent the reserve labor available to the town's industry for seasonal variations and turnover. The increase in the number of persons engaged in manufacturing activities (21 percent) signifies a proliferation of domestic or autonomous craft production rather than a growth of industry. There are only three industrial enterprises with more than 100 employees (Vegetex, Morais e Cia., and Tropical de Alimentos). Most of those occupied in the manufacturing sector, according to demographic censuses, work in craft and repair activities, as well as in civil construction, which is in fact mostly represented by craft activities.

The employment situation for commerce is similar to that for the industrial sector. The 1970 Commercial Census registered 1,025 wholesale and retail establishments employing 1,824 persons. The Demographic Census showed that 2,751 persons were habitually engaged in commercial activities. This discrepancy can be explained primarily by the seasonal nature of agriculture and extraction: trading in goods fluctuates with agricultural supply, and job opportunities vary as a result. It is probable that, as with industry, this seasonal variation entails modifications in the size of the autonomous sector, rather than a variation in demand for manpower. At present, Parnaiba can be seen as undergoing a rapid increase in the numbers of people occupied as "autonomous" or self-employed intermediaries in the circulation of commodities. Of the 1,824 persons registered by the Commercial Census, the Demographic Census classed 1,725 as being in this category. As regards local subsistence products, contrary to what might be expected of an economy based on small autonomous production, direct exchange does not predominate, but a multiple circuit based on buying and selling operations. As regards consumer products imported from other regions, the situation is more complex: although there are some wholesale firms, most of the large retail establishments seem to prefer to purchase their goods directly from larger markets, and to this end have representatives in or send buyers to Fortaleza, Rio, and Sao Paulo.

The low rates of pay common to several categories of employees and autonomous workers explains why they must resort to a combination of agricultural, extractive, craft, industrial, and commercial activities to ensure the minimum earnings needed for survival. In 1970, 47.8 percent of those occupied in industry earned less than $100 cruzerios (which then represented 80 percent of the legal minimum wage for the region). Among these workers, that proportion was greater for employees (49.9 percent), and less for autonomous workers (47.4 percent), and those in commerce (47.2 percent). In the service sector, the corresponding figures were 84.5 percent for employees and 74 percent for autonomous workers.

The public sector is a major factor accounting for employment levels in Parnaiba. The pace of public works has a considerable influence on variations in job levels, while welfare and government health service agencies seem to be responsible for much of the municipality's monetary income. This is why a situation characterized by the existence of large numbers of unemployed workers can con-

tinue, and why a large part of local commerce can survive. In 1970, 6,720 of the total urban labor force of 15,052 persons were calculated to have been laid off for health or other reasons according to the books kept at the Parnaiba branch of the INPS (Instituto Nacional de Previdencia Social--the governmental agency in charge of social security and the health services). Given the stagnation of the region's productive activities, it can be seen that much of the monetary circulation that enables small commerce to survive in Parnaiba is injected by the INPS, and secondarily by the FUNRURAL (Rural Workers' Welfare Fund). The employment situation will be significantly altered only if there are even greater injections of government resources than those currently maintaining an active local market.

A summary of the main demographic indicators for Parnaiba for the period 1940-70 is presented in Table A.1

CACHOEIRO DE ITAPEMIRIM*

The growth of the coffee trade was the main factor in the occupation of the territory now comprising the municipality of Cachoeiro de Itapemirim and its surroundings, in the south of Espirito Santo state. Settlement began in the early 1700s as a result of the hunt for gold in the Castelo mines and the setting up of the first sugar mills along the banks of the River Itapemirim; however, it was not until the middle of the nineteenth century that the expansion of the coffee trade in the states of Minas and Rio generated a definitive settlement of the Espirito Santo tablelands, where Cachoeiro de Itapemirim lies. This period was also decisive in reinforcing the strategic position occupied by Cachoeiro de Itapemirim since its foundation as a polarizing center for both the economic activities and communications in the south of the state. The coffee trade brought the Leopoldina railroad as far as Cachoeiro, which thus became an entrepot for the entire region's production on its way to the port of Rio de Janeiro, via Cachoeiro-Campos.

When the coffee trade began to decline, its place was taken by livestock breeding, mostly of dairy cattle. Cachoeiro was also to be a nucleus for the dairy

*Summary by Sales (1979).

TABLE A.1 Dynamics of the Population of Parnaiba (municipality[a]), 1940-70: Brazil

Year	Total Population	Rate of Growth (percent)	Decomposition of Natural Increase		Decomposition of Birth Rate	
			Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)	General Fertility Rate (per 1,000)	Proportion of Women Aged 15-49 in Total Population (percent)
1940	42,062		25.0	49.8	189.0	26.3
		4.33				
1950	64,260		22.9	48.9	185.0	26.3
		1.75				
1960	76,469		20.6	49.9	197.0	25.3
		2.52				
1970	98,113		18.7	49.9	207.9	24.0

[a]The municipality covers the urban and rural population.

Source: Berquo and Jose (1978).

production of the state's southern region, particularly after the founding of the Cachoeiro de Itapemirim Dairy Cooperative in the 1940s and continuing to the present, when it absorbs the production from 18 neighboring municipalities. The major consequence of this shift to dairy cattle breeding is shown by Cachoeiro's declining rural population, which from 1950 to 1970 fell from 53,701 to 42,903; this represents a drop from 66.2 percent to 40.1 percent of the municipality's total population. Its urban population, however, has been constantly growing: in 1970, it reached 64,219, or 59.9 percent of the total, thus overtaking the rural population in relative terms.

This growth in Cachoeiro's urban population is certainly due mainly to the influx of migrants attracted to the town as the center of economic activities in the entire southern region of the state. However, this has not been the only result of the shift of population out of the municipality's rural areas. This migration has very probably reached not only Cachoeiro, but also, and above all, other rural areas in the same state or even other states with an emerging agricultural frontier; in fact, most of those who have migrated to the town of Cachoeiro have come from neighboring towns. Some data from field observation and secondary sources support this hypothesis. First, the main labor relation in the local coffee plantations is the half-share sharecropping system, with a predominance of small producers. This leads the producers naturally to look for other agricultural frontier regions when their own plantations undergo a crisis; prior to the decline in the coffee plantations, this had already been observed in the migration of small producers from the south to the central region of the state. Second, the municipality as a whole had a negative migratory balance for 1960-70. Given the urbanization level observed for the municipality during the same decade, it is probable that this balance would have been positive if a large proportion of those who emigrated from the countryside had gone directly to the town of Cachoeiro.

The initial industrial thrust in Cachoeiro at the beginning of the century was significant for the later consolidation of urban society there, as well as for its recent industrial growth, still based mainly on the exploitation of the municipality's natural resources. Although no quantitative data are available for the years following 1970, it seems undeniable that the town has undergone its most significant growth over the last 10 years because of the expansion of its dynamic industrial

sector and the resulting increase in commerce and services in general. The influx of immigrants to the town can be seen in the expansion of the urban site itself, which has begun spreading out along the banks of the River Itapemirim toward the hills around the town. There has been intense civil construction work over the last 10 years, above all in the building of new housing estates throughout the town's outskirts.

Industrial Census data show a degree of stabilization in Cachoeiro's industrial sector between 1940 and 1960; from then up to 1970, there was a substantial growth both in the number of establishments and employees, and in the value of manufacturing operations. Of the various kinds of industry, those which grew most over this period were the extraction and production of nonmetallic minerals; the basic raw material in this field comes from the reserves of limestone and marble located in the municipality near the town of Cachoeiro. The largest and most diversified marble and granite producers, however, began operations or expanded out of already existing marble and granite cutting workshops in the late 1960s and early 1970s. Between 1970 (date of the last census) and 1979, when the field survey was carried out, the number of firms in this sector decreased (from 80 to 45 establishments), while at the same time the number of employees substantially increased (from 1,214 to 2,100). This would seem to indicate that during this period, the industrial sector underwent continuous vertical expansion, with the firms involved growing, diversifying production, and absorbing other existing workshops.

Along with this industrial sector made up mostly of medium and large factories engaged primarily in exporting their products, Cachoeiro also has a large number of small factories, most of which are engaged in supplying local consumer needs. The great majority of industrialists are native to the municipality, while many of its large-scale enterprises arose as a result of individual initiative. The latter managed to expand their businesses into large factories, such as the present-day Itapoa de Calcados (footwear), or even local empires, such as the Itapemirim Group, whose main business is long-distance passenger transport, but whose activities also include a whole range of both service and industrial undertakings.

A summary of the main demographic indicators for Cachoeiro de Itapermirin for the period 1940-70 is presented in Table A.2.

TABLE A.2 Dynamics of the Population of Cachoeiro do Itapemirim (municipality), 1940-70: Brazil

Year	Total Population	Rate of Growth (percent)	Decomposition of Natural Increase		Decomposition of Birth Rate	
			Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)	General Fertility Rate (per 1,000)	Proportion of Women Aged 15-49 in Total Population (percent)
1940	72,834		23.3	47.1	199.1	23.6
		1.08				
1950	81,082		21.7	44.9	194.7	23.0
		1.08				
1960	90,271		19.1	45.5	195.9	23.2
		1.73				
1970	107,122		16.9	41.5	175.1	23.7

Source: Berquo and Quintero (1979).

SAO JOSE DOS CAMPOS*

Within the framework selected by the NIHR, Sao Jose dos Campos represents the case of modern Brazilian capitalism powered by the forces of big oligopoly capital. Like the other towns in the Vale do Paraiba region, until the early years of the present century, Sao Jose had an economy based on coffee planting. Unlike the other towns, however, it did not slump when the coffee axis shifted to the western part of Sao Paulo state; rather it developed by replacing coffee partly with semisubsistence activities and partly with livestock and dairy cattle breeding. At the same time, being a point of rail, and later road, intersection, it served as an entrepot for goods being transported from the large urban centers to the coastal ports. It was in the 1950s, and especially in the 1960s, that Sao Jose began to take on the features of a modern Brazilian capitalist development because of the enormous industrial boom that took place at this time. This boom involved an industrialization process based on large-scale enterprise; above all, it was a "modern" process in that it was based on the expansion of oligopolies, or the so-called multinationals.

The distinctive marks of this process can be seen both in the forms of economic organization that arose and in the structure of local society: since industrialization was based on the investments of large firms with head offices outside the area, it operated through so-called "organizational policies" implemented by employees operating on site (executives, managers, personnel heads, technicians, and engineers). At the same time, the process of industrialization and modernization formed the workers into the "masses." This was in fact a caricature, however, for they kept one foot in their past as migrants and the other foot in the system of aspirations, which suffered drastic changes in the space of a few years.

Along with these characteristics, there arose an intermediary of great strength--the government and its agencies, and the weight of its "modernizing bureaucracy." Government action contributed to economic growth from 1950 onward, when the Centro Tecnico da Aeronautica (Air Force Technical Center) was set up. This was initially made up of technical and aeronautical engineering schools, but

*Summary by Maria Lucia Indjaian, based on Cardoso (1975).

later developed the nuclei of an aeronautics industry. A further contribution now being made by the state is the installation of huge facilities belonging to Petrobras (the state oil monopoly) for the construction of refineries.

From 1960 onward, moreover, Sao Jose saw a change in the pattern of its population dynamics. In 1960, there were 76,997 inhabitants, a figure which rose to 148,332 by 1970; of the latter, 74,395 were born outside the municipality, and 94.2 percent of these were located in the urban area. Most of the migrants in the local population were of Brazilian nationality, the majority from the states of Sao Paulo (48.94 percent) and Minas Gerais (37.09 percent). There were 2,651 foreigners (2 percent of the population), the same proportion as had been registered for 1920, 1940, and 1950. As regards the urban or rural origins of the migrants, the available data show that around 23,000 persons from the rural area were present in the urban area in 1970; this suggests that the rural area must have had little capacity to absorb workers. In 1940, the rural population represented 63.5 percent of the total population, falling to 11 percent in 1970.

The degree of change undergone by the municipality's productive structure is reflected in its employment structure. There has been a rapid decrease in the economically active population in the primary sector; in 1940, it represented 60.86 percent of the labor force, and by 1973, it had been reduced to 2 percent. At the same time, there was an increase in the secondary sector, which by 1973 comprised 51 percent of the labor force; the remaining 47 percent was distributed among the commercial and service sector (24.5 percent), public administration (11 percent), autonomous workers (11 percent), and others (0.3 percent). Meanwhile, women's participation in the labor force increased considerably: it grew in the tertiary sector to 68.69 percent, where it was concentrated in individual consumer services (39.96 percent) and others, although it lost relative importance in the primary (1.89 percent) and secondary (29.42 percent) sectors.

These data indicate the proportionally greater increase in individual consumer services than in production services for the years after 1950 in Sao Jose. It is true that the collective services sector also grew (education, police, health, etc.); indeed, for the latest intercensal interval, this sector grew more than individual consumer services. Even so, the number of domestic servants,

chauffeurs, snack bars, and so on greatly increased along with the so-called "modernization" caused by industrial growth. This shows in turn that Sao Jose is no exception to the occupational pattern created by the prevailing style of dependent capitalist society. In parallel, there was an expansion in tertiary social areas (along with the state bureaucracy), and social consumer services continued to expand.

As regards wage distribution in 1970, in general, white collar employees earned twice as much as workers, although this gap was greater in some industries than in others. There was also a strong average differentiation among wages within the various industries for both white and blue collar workers. Those industries with the highest pay for blue collar workers were chemicals and transportation materials; together, those industries absorbed 37 percent of occupied blue collar workers in Sao Jose, and thus forced the average wage upward. On the other hand, 32 percent of blue collar workers earned less than half the average wage of all workers in the two industries referred to above; the corresponding figure for foodstuffs or metallurgy is 25 percent. Despite these wage differentials, however, the population's living standard did not move beyond a "relative poverty horizon."

As for rural economic activity, until 1960, the "absolute population level" remained steady, although it slowed in some periods. This activity comprised mainly cultivation of rice, Irish potatoes, and sugarcane (especially for fodder). There was also livestock (mainly dairy cattle) and poultry breeding; the latter, along with market gardening, was intensified through use of the low-lying land along the River Parnaiba. Dairy production and livestock breeding were not adversely affected by the industrial boom; on the contrary, they even increased after 1950, despite the loss of rural population. This suggests that resources were used to greater advantage and that production was focused in large-scale agricultural enterprises.

A summary of the main demographic indicators for Sao Jose dos Campos for the period 1940-70 is presented in Table A.3.

CONCEICAO DO ARAGUAIA*

Conceicao do Araguaia was founded in 1897 as a combined catechistic mission and hinterland settlement. Over the

*Summary by Maria Lucia Indjaian from Ianni (1978).

TABLE A.3 Dynamics of the Population of Sao Jose dos Campos (municipality), 1940-70: Brazil

Year	Total Population	Rate of Growth (percent)	Decomposition of Increase (percent)		Decomposition of Natural Increase		Decomposition of Birth Rate	
			Migration	Natural Increase	Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)	General Fertility Rate (per 1,000)	Proportion of Women Aged 15-49 in Total Population (percent)
1940	32,324		--	--	--	37.9	143.5	26.4
		3.3						
1950	44,804		--	--	25.8	39.4	154.9	25.4
		5.6						
1960	76,997		46.9	53.1	14.3	42.1	170.4	24.7
		6.8						
1970	148,332		48.2	51.8	9.4	34.5	141.8	24.4

Source: Berquo (1975).

years up to 1912, its economy was based on monoextraction of caucho-type rubber, and the town underwent a growing influx of immigrants. These were mainly from the Goias, Maranhao, and the Piaui hinterlands; they arrived looking for industrial and commercial work.

With the beginning of the rubber crisis in 1912, the municipality began to diversify its extractive economy by combining it with agriculture and livestock breeding. This economy, of the peasant type and partially mercantile, prevailed until 1960. Production mainly served the producer's own needs or those of local commerce, as well as trade with Belem; the main products were rice, corn, beans, cassava, cotton, tobacco, sugarcane, and coffee. Livestock breeding was also carried on, mainly of cattle, horses, and pigs.

During the years from 1960 to 1977, the economy and society of Conceicao do Araguaia changed more rapidly, which in turn brought about changes in all social relations and activities. Two events were central to this process. The first was the construction of the Belem-Brasilia highway, completed in 1960, and later connected by another highway to Conceicao do Araguaia. This brought new possibilities for the exchange of goods, people, and information, as well as communication with Goiania, Anapolis, Belem, Brasilia, and other towns. The second major event was the setting up of SUDAM, the Superintendency for Development of the Amazon, in 1966. This official agency was established to provide concessions for investors through tax and credit incentives, thus facilitating the introduction of livestock breeding and agricultural enterprises. Its activities are still being carried on in the region encompassing the municipalities of Conceicao do Araguaia and Santana do Araguaia.

These stimuli led to a rise in population, from 11,283 in 1960 to 28,953 in 1970. Of these, 65.4 percent were not born in the municipality, but had come mainly from Goias (16,610) and Maranhao (2,779). Most were landless peasants looking for land on which to squat and for better working conditions and therefore emigrated to the countryside. In 1970, the great majority (83.41 percent) of the population was engaged in agriculture and livestock breeding, along with extractive activities. The rest (430 persons) were absorbed by activities located in the urban center, but closely linked to rural production.

A comparison of some of the available data shows the changing character of the landowning structure. In 1950, there were 292 occupants (posseiros, or squatters) and one

landowner (big farmer) with control of land in the municipality. The occupants were responsible for about 96 percent of rural establishments and occupied over 91 percent of the land involved. In 1970, the 2,136 occupants accounted for over 95 percent of rural establishments, but occupied only 43.64 percent of the land; at the same time, there were 100 landowners, who accounted for 4.46 percent of rural establishments and occupied 56.33 percent of the land.

According to data collected by IBGE (Brazilian Geodesics and Statistics Institute), agricultural and livestock production grew overall in the years from 1960 to 1970, and the number of rural establishments rose from 982 (1960) to 2,242 (1970). The composition of the population engaged in agriculture and livestock breeding in 1972 clearly shows this change. In 1972, INCRA (National Settlement and Agrarian Reform Institute) registered 857 permanent wage workers and 7,011 temporary workers. Of these, the peao, or unskilled wage laborer (mostly of migrant origin, as well as a peasant in the process of proletarianization), was the central figure in the formation and expansion of the large agricultural enterprises. Thus, it is above all in the countryside that the bourgeoisie and proletariat were increasingly taking shape. On the one hand, there were the landowners, the fazendeiros, and the entrepreneurs or their agents; on the other, there were the rural laborers and cowhands. Alongside with these, there were the peasant nuclei of smallholders, squatters, and colonos, all in a critical phase of reorganization or dissolution.

This peasantry, whose economy originally consisted of family labor and was at a very low technological level, and who produced mainly for their own consumption, began to produce for selling on the urban market, where the demand for agricultural and extractive products was constantly rising. Together with this growing articulation between the peasant economy and the market, the peasant was increasingly dependent on a supply of merchandise (both essential and superfluous) generated by industrial capital. This dependency developed and led to a dissolution of the peasant economy. A large number of the peasants were transformed into disguised wage-earner, or simply proletarianized; others, longstanding or recent squatters, managed to have their legal situation redefined and thus received permission to occupy or even own the land, becoming colonos. According to INCRA, in 1971, 90 percent of all rural establishments were in the hands of

squatters (posseiros), who occupied 39 percent of the land; about 9 percent consisted of rural real estate with title deeds, comprising 60 percent of the land.

These data help clarify how the area's formation and expansion of agricultural enterprises has taken place. The crisis undergone by the peasantry is a specific aspect of this expansion, involving the struggle for possession or ownership and control of the land, the expulsion and proletarianization of the autonomous producer, and the expropriation of the most important means of production and subsistence--the land.

The antagonism between landowners and squatters took many different forms, from legal negotiations to armed struggle. Despite legislation designed to protect the squatters, the significant laws supported the policies implemented by SUDAM, Banco da Amazonia S/A (BASA), and other federal and state government agencies to protect the formation and expansion of medium and large agricultural enterprises. In short, the process underway in Conceicao do Araguaia--one which helps to clarify the social and economic relations in the municipality--is private appropriation of the land under the control of big capital, with the political and economic protection of the state.

SERTAOZINHO*

Sertaozinho was shaped by the expansion of capitalism in the agrarian world, and serves as a good example of the society and economy constructed by the coffee trade in the west of Sao Paulo state in the late nineteenth and early twentieth centuries (1880-1930). This period was characterized by the strong influence of coffee, planted as a commercial crop mainly in compliance with international demand. This dominated all other activities, such as sugarcane and cotton planting, foodstuffs, crafts and manufacturing, transportation, and commerce. As it progressed, the monoculture of coffee brought about a reorganization of the productive forces. While a free labor system was being set up, a local market was created in connection with the regional one and with the country's most dynamic centers. This in turn involved the transformation of unoccupied public land into private property

*Summary by Maria Lucia Indjaian from Ianni (1976).

and the occupation and concentration of landed property. This period also saw increased immigration, mainly of Italians, into the coffee plantations.

The expansion of coffee created local and regional economic subsystems. With these came a more dynamic society and economy, even with the advent of the coffee crisis. Crops were then combined--some perennial, such as coffee, and others temporary, such as beans, corn, and cotton. From 1918 onward this process became more intense and structurally significant, for in that year Sertaozinho suffered a serious frost. In 1924 and 1926, there was drought. All this, added to the 1929 economic slump, led to severe unemployment, with a steep upsurge in the reserve force of agricultural laborers. Some of these laborers attempted to adjust to other agricultural activities, while others went to the towns.

Sugarcane was cultivated in Sertaozinho from the end of the nineteenth century onward, and in the 1930s began gradually to increase in importance; by 1944, the land area devoted to sugarcane had overtaken that of coffee, and by 1953 that of coffee and cotton together. The municipality continued to produce coffee, cotton, corn, peanuts, rice, and other products for local consumption and for trading outside the region. However, the main product remained sugarcane. In 1968, it accounted for 90 percent of the value of agricultural production. This result was repeated in 1970, but increased in 1974, when the figure was 92.6 percent; there were then five sugar mills producing for the regional and foreign markets, in accordance with policies coordinated by the IAA (Sugar and Alcohol Institute).

The organization of productive activities to meet the demands of the sugar industry led to a restructuring of the municipality's productive forces. From 1940 to 1972, there was a significant reorganization of Sertaozinho's landowning structure. The number of rural units fell from 780 to 515, and the sugar mill, understood as a productive complex including the mill itself and the surrounding plantations, became the dominant agro-industrial nucleus. The population working at a mill now comprises rural laborers and industrial workers, supervisors, inspectors, foremen, administrative employees, technicians, and owners. At harvest time (June to December), this population is joined by temporary hired laborers (known as boias-frias or volantes) from the outskirts of Sertaozinho, or from other towns or states, mainly Minas Gerais, Bahia, and Pernambuco.

The growth of the sugar industry has led to the expulsion of some workers and to the redefinition of working conditions for those who remain. This change has occurred not only because of an interest in increasing and improving production, but also because of the formalization of production relations according to the legal, political, and economic requirements imposed by the state or the IAA. The social division of labor during and between harvests has developed so that the production relations are distinct for different segments of the proletariat. The colonos* have tended to become permanent or temporary laborers on a daily or monthly wage, and the colonato system in agriculture has thus been dissolved. This process has also tended to reduce the number of permanent laborers employed and increase the contingent of temporary laborers. According to INCRA, in 1972 only 11 rural properties were being worked by sharecroppers, 21 in number, only 10 of whom had a written contract.

With this modification in production relations in the countryside, the sugar industry has indirectly imparted new energy to the town, to which a significant part of the rural population has migrated. It has thus contributed to a gradual increase in the urban population, which by 1960 had become larger than its rural counterpart: in 1940, 25 percent of the population was concentrated in the urban area and 75 percent in the countryside; the figures for 1970 show an inversion of this composition. This change was accompanied by the influence of migration from other municipalities and states, which was mainly concentrated in the urban area. The rural population fell, became progressively urbanized, and became consumers of the urban world's production.

The continuous expansion of the sugar industry and the resulting change in the organization of production also led to corresponding changes in other agricultural activities (soybeans, corn, rice, peanuts, and other crops). In addition, industrial production grew and diversified,

*Colono/Colonato: In Sertaozinho, these terms do not refer to squatters or owners of land, but rather to a system whereby the owners of the big estates granted a cottage and small plot for subsistence to those working on their lands or at the mills. With the dissolution of this system, these workers lose such rights and are evicted from the land.

absorbing 60 percent of the municipality's economically active population; in certain cases, this involved the primary sector. Industrial establishments increased in number from 33 in 1940 to 172 in 1973. In the same year, metallurgical and mechanical firms, mainly engaged in production and repair of machinery and equipment for the sugar industry, employed 50 percent of all persons occupied in the industrial sector. New capitalist production patterns became generalized through the influence of the sugar market; the relations of mutual dependence and antagonism between town and country, agriculture and industry, workers and bourgeoisie all changed as a result.

A summary of the main demographic indicators for Sertaozinho for the period 1940-70 is presented in Table A.4.

SANTA CRUZ DO SUL*

The lands in the settlement of Santa Cruz do Sul were occupied from 1849 onward. In that year, 77-hectare plots were distributed as an incentive to foreign immigration, which was needed to make up for the scarcity of manpower, especially in the field of agricultural exports, and to promote the free land system. The migratory influx to Santa Cruz do Sul steadily increased until the end of the nineteenth century and was mostly made up of German settlers.

The economy of Santa Cruz was based from the start on family agricultural production for export. Its main product was tobacco, but there were also lard, Paraguay tea, beans, and corn. Together with these activities, this development of an export trade in agricultural products led to an accumulation of capital, which in turn facilitated the installation of production units along capitalist lines. From 1918 on, most of the firms in the town were engaged in processing agricultural products (drying tobacco, refining lard) and preparing them for export as raw materials. This led to an expansion of tobacco-related activities and a decline in those related to products sold on the home market, subsistence, or pig breeding, thus making the municipality's economy more and more dependent on a single product.

*Summary by Maria Lucia Indjaian, from Lima (n.d.) and Oliveira (1975).

TABLE A.4 Dynamics of the Population of Sertaozinho (municipality), 1940-70

Year	Total Population	Rate of Growth (percent)	Decomposition of Increase (percent)		Decomposition of Natural Increase		Decomposition of Birth Rate	
			Natural	Migratory	Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)	General Fertility Rate (per 1,000)	Proportion of Women Aged 15-49 in Total Population (percent)
1940	21,290		--	--	19.34	39.88	179.08	22.27
		-0.45						
1950	20,357		--	--	9.53	40.28	173.14	23.26
		4.87						
1960	32,753		58.5	41.5	8.65	34.78	152.07	22.87
		1.89						
1970	39,496		135.7	-35.7	7.70	29.57	124.95	23.67

Source: Berquo and Jose (1976).

There was also a greater fragmentation of rural property, reaching a peak between 1920 and 1940. Over this period, the average area of properties fell from 40 to 26.93 hectares, while the number of establishments with between 1 and 20 hectares grew. This considerable reduction in the size of properties meant that it was no longer possible to maintain the system of dividing them up according to inheritance; thus some owners' children were forced off the land, to undergo a process of proletarianization in later years when the town's industrialization was under way.

The process of emigration from the rural zone, already intense in the 1940s and 1950s, became more so in later decades as the parceling out of property continued. It was also encouraged by the tobacco crisis since this product dominated the municipality's agricultural and industrial economy. The tobacco crisis was partly caused by the federal government's inflationary policies from 1962 onward, and partly by a failure to update production techniques. As a result, this major export lóst its market competitiveness. This in turn led to the introduction of foreign capital, which was gradually invested in the purchase of the existing tobacco factories.

The landowning structure of Santa Cruz do Sul is characterized by a predominance of small agricultural establishments: in 1970, the Agricultural Census registered 8,226 establishments in the municipality, absorbing 27,423 persons. There are, however, no precise data on the number of people engaged in tobacco planting. The proportion of wage-earners is small (around 10 percent of the economically active population), as is the share of tenant farmers, squatters, and occupants (around 8 percent). The majority consists of smallholders (colonos) and members of their families (82 percent), who are engaged in subsistence production, along with tobacco and soybean planting and pig breeding.

These activities are carried on in the area where German settlers predominate, which is also the richest. The northern part of the municipality, occupied mainly by Italians, has different features. Here, properties are relatively larger, the ground is less even, and livestock breeding thus predominates, along with Paraguay tea extraction. Wage labor is also common in this area.

Industrial activities are an extension of agriculture, especially tobacco processing and cigarette manufacturing. The 1970 Industrial Census registered 5,287 persons occupied in industry, of whom 3,899 were in production.

Among these, the tobacco industry (including cigarette factories and tobacco-processing plants) employed 1,141 persons as permanent workers. The processing plants are directly linked to the planters; they render technical assistance, supplying fertilizers and insecticides, and finance the construction of curing barns. Thus, the planters are distinctly dependent on these processing firms: although there is no formal contract, any planter who fails to sell his production to the firm that financed him will stand little chance of receiving financial aid in the future.

The tobacco-processing firms employ few permanent workers since their demand for labor increases 3-5 times at the harvest peak (March-April). Souza Cruz has 200 permanent employees, but at harvest time this rises to 1,000. No preference is shown to either sex in the employment of harvest workers (usually it is 50 percent for each), and workers may be either single or married. They work for the processors around 3-4 months every year. The rest of the year they are employed in civil construction or do odd jobs. A few emigrate to Rio Pardo or Cachoeira do Sul, where they work on the rice or wheat harvest, while some remain unemployed. The women usually work as domestic servants in private residences.

Of the large enterprises outside the tobacco industry, the most important are a meat packing plant and a rubber goods factory. The remaining enterprises--mainly lumbering and the manufacture of furniture, perfume, and beverages--employ relatively few workers. In fact, there are many small firms with few or no employees; on the basis of the census data, it can be assumed that most industrial establishments employ on average less than 10 persons.

Along with industrial activities, Santa Cruz has small and medium-sized commerce that serves the needs of the municipality and its neighbors. Most of the larger tradesmen are former tobacco entrepreneurs who, in the late 1960s and early 1970s, were brought up by international groups. It is impossible to obtain a clear picture of the occupational categories in commercial activities from the 1970 Commercial Census since it also includes information on industry. The 1960 census, however, clearly shows a predominance of proprietors and their families in commerce, mainly in the retail sector (39 percent wage-earners); in contrast, wage-earners predominated in wholesale commerce (76.7 percent). The service sector also remained small, absorbing around 7 percent of the municipality's economically active population; of

these, 71 percent were proprietors and their families, and 29 percent were wage earners.

Although urban activities were consolidated and absorbed a growing share of the number of occupied persons between 1940 and 1970, the agricultural sector retained the largest share of the municipality's labor force (63 percent), a share that was permanently threatened by the pressure of big capital.

A summary of the main demographic indicators for Santa Cruz do Sul for the period 1940-70 is presented in Table A.5.

TABLE A.5 Dynamics of the Population of Santa Cruz do Sul (municipality), 1940-70: Brazil

Year	Total Population	Rate of Growth (percent)	Decomposition of Natural Increase	
			Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)
1940	55,041		12.50	36.55
		2.38		
1950	69,605		18.49	35.96
		2.16		
1960	86,147		7.44	36.57
		1.33		
1970	98,714		7.94	31.39

[a]These population figures also include Vera Cruz, because until 1959 it was part of the municipality of Santa Cruz do Sul.

Source: Godinho (1980).

RECIFE*

In the earliest years following its foundation, Recife expanded into the hinterland occupied by the first primitive sugar mills of the colonial period. The town was also linked with the sugar economy through migration since it was the natural channel through which the rural exodus passed on its way from the Zona da Mata. In the 1950s,

*Summary by Sales (1980).

when the population of the town of Recife most increased, the proportion of the migratory increase to the total population growth was nearly 50 percent. The few data available point to the fact that these migrants came above all from the Zona da Mata, a hinterland region which in turn receives migratory currents of a temporary or permanent nature (the so-called corumbas from the Agreste region) coming from regions even farther inland in the same state.

The Zona da Mata therefore forms a green belt around Recife, as happens with other regional metropolises. However, it does not supply the town with foodstuffs--only with migrant population. Apparently, the structural conditions associated with changes in the sugar economy led to this emigration from the sugar-producing region, most of which empties into Recife. The urban problems generated by this sizable influx of migrants can be seen above all in the proliferation of shanty-towns (locally known as mocambos) in the waterlogged outskirts of the town.

The dynamics of interregional integration under the hegemony of the Center-South and its process of industrialization resulted both in the intensification of commerce and migration between regions and in the growth of Recife after 1950. The integration of the Northeast into the model of capital accumulation (whose hegemonic pole was located outside the region) led to the disorganization of the agrarian and productive structure of the Recife hinterland and thus further encouraged migration into the town. Recife's urban problems therefore became linked to those of the region, which centered on the decline of local productive activities.

The same factors which account for migrations at the macro-structural level also account for the disorganization of certain industries. The introduction of manufactured goods from the Center-South was the main reason for the closing down of certain branches of Recife's industry, in particular the textile industry. This helps to explain the creation of SUDENE (Superintendency for Development of the Northeast) in 1959, with headquarters in Recife. The primary objective of this agency was to resolve these problems by revitalizing industry, creating jobs, and diversifying production.

The appearance of SUDENE marked a new era in the life of the town of Recife, primarily because of the new dynamics of urban employment resulting from the industrial projects implemented in the Northeast through tax incentives. In the 1960s, industry in the metropolitan area

received a new injection of resources. However, this in fact led to an increase in manufacturing production rather than in the number of jobs, indicating the importance of the technological component in the industrialization of the Northeast under the auspices of SUDENE. The effect of the reorganization of industry in the area on the labor force can be seen in a drop in employment in the secondary sector in municipalities that traditionally housed a major portion of the state's textile industry (Paulista and Moreno).

The greatest growth was in the tertiary sector, especially in those branches where urban underemployment had been heaviest. If the various census data are combined with the findings of anthropological investigations carried out in Greater Recife, the most salient recent feature of the occupational structure in Recife's metropolitan area that emerges is intense fluctuation in the labor force between employment, unemployment, odd jobs, and various kinds of underemployment. Attention must also be paid to the increasing importance of the so-called informal sector in the economy as a whole, particularly during the post-SUDENE period; one example would be small commercial establishments, whose initial capital often depends on the small trader's position in the regular labor market.

The conflicts between the intense population growth, the poor living conditions in the marshland shantytowns, and the rising value of urban land after 1960 led to a new kind of migratory movement--intrametropolitan migration. This movement led to considerable population increases in the 1960s in the municipalities of Olinda, Jaboatao, and Sao Lourenco da Mata, which underwent a process of urban expansion as if they were outlying districts of Recife itself.

A summary of the main demographic indicators for Recife for the period 1940-70 is presented in Table A.6.

TABLE A.6 Dynamics of the Population of Recife (municipality), 1940-70: Brazil

Year	Total Population	Rate of Growth (percent)	Decomposition of Absolute Decennial Increase (percent)		Decomposition of Natural Increase		Decomposition of Birth Rate	
			Natural	Migratory	Crude Death Rate (per 1,000)	Crude Birth Rate (per 1,000)	General Fertility Rate (per 1,000)	Proportion of Women Aged 15-49 in Total Population (percent)
1940	348,424				22.83	44.34	143.70	30.86
		4.18	38.71	61.29				
1950	524,682				18.58	45.58	148.90	30.61
		4.16	58.57	41.43				
1960	788,336				13.41	46.99	166.25	28.27
		3.01	96.76	3.24				
1970	1,060,701				10.12	46.00	166.29	27.66

Source: Jose (1981).

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COMMITTEE ON
POPULATION AND DEMOGRAPHY

Report No. 24

Vital Rates in India, 1961-1981

P. N. Mari Bhat
Samuel Preston
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Panel on India
Committee on Population and Demography
Commission on Behavioral and Social Sciences and Education
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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State. It was widely felt by those concerned that the time was ripe for a detailed review of levels and trends of fertility and mortality in the developing world. Although most people in the demographic community agree that mortality has declined in almost all developing countries during the last 30 years, there is uncertainty about more recent changes in mortality in some countries, about current levels of fertility, about the existence and extent of recent changes in fertility, and about the factors determining reductions in fertility.

In 1963, a Panel on Population Problems of the Committee on Science and Public Policy of the National Academy of Sciences published a report entitled The Growth of World Population. The appointment of that panel and the publication of its report were expressions of the concern then felt by scientists, as well as by other informed persons in many countries, about the implications of population trends. At that time, the most consequential trend was the pronounced and long-continued acceleration in the rate of increase of the population of the world, and especially of the population of the poorer countries. It was estimated in 1963 that the annual rate of increase of the global population had reached 2 percent, a rate that, if continued, would cause the total to double every 35 years. The disproportionate contribution of low-income areas to that acceleration was caused by rapid declines in mortality combined with high fertility that remained almost unchanged: the birth rate

was nearly fixed or declined more modestly than the death rate.

Since the earlier report, however, the peak rate of growth in the world's population has apparently been passed. A dramatic decline in the birth rate in almost all the more developed countries has lowered their aggregate annual rate of increase to well below 1 percent, and the peak rate of increase has also apparently been passed in the less-developed parts of the world as a whole. A sharp decline in fertility in many low-income areas has more than offset the generally continued reduction in the death rate, although the rate of population increase remains high in almost all less-developed countries.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the Committee on Population and Demography was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);

3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee decided to concentrate its initial efforts on the first two tasks; it initiated work on the third task in 1979.

By 1982, 168 population specialists, including 94 from developing countries, had been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee approaches the first task through careful assessment, by internal and external comparison, and through analysis, by application of the most reliable methods known, of all the data sources available. Each of the country studies therefore consists of the application of a range of methods to a number of data sets. Estimates of levels and recent trends judged to be the best that are feasible with available resources are then developed on the grounds of their consistency and plausibility and the robustness of the individual methods from which they were derived.

The committee's second task, refinement of methodology, is seen as a by-product of achieving the first. The application of particular methods to many different data sets from different countries and referring to different time periods will inevitably provide valuable information about the practical functioning of the methods themselves. Particular data sets might also require the development of new methodology or the refinement of existing techniques.

The third task of the committee, evaluation of factors determining birth rates, is the most difficult. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the committee and the Commission on Behavioral and Social Sciences and Education established the separately funded Panel on Fertility Determinants, which includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel.

This report, on levels and recent trends of fertility and mortality in India is Report No. 24 in a series of

reports issued by the Committee on Population and Demography. It is the result of work by the Panel on India, created by the committee and the Commission on Behavioral and Social Sciences and Education in 1978. The panel met twice and then sponsored a workshop in New Delhi at which several papers were presented and discussed. P. Padmanaba, Registrar General and Census Commission, India, and a panel member, assisted greatly with the organization of this workshop. In addition to panel members, the workshop participants included the committee chair, Ansley J. Coale, and several scholars and officials from various states of India.

Drawing upon the papers prepared for the workshop and more recent materials including available data from the 1981 census of India, this report was written by P. N. Mari Bhat, Samuel H. Preston, and Timothy Dyson. It would not have been possible without the abundant cooperation of the Office of the Registrar General of India. The Registrar General suplied published and unpublished tabulations on request and commented extensively on work commissioned by the panel. Hania Zlotnik provided staff support for the panel for 1978-81. Robert J. Lapham provided staff support after that and prepared the Summary.

In addition to financial support from AID, the preparation of this report was supported financially by general-purpose grants to the Univeristy of Pennsylvania from the William and Flora Hewlett Foundation and from the National Institute of Child Health and Human Development. The foundation also supported the printing costs through a grant to the National Academy of Sciences for that purpose.

Several individuals assisted with the many report production details. Shobhana Sheth ably typed the many tables and oft-revised text at the University of Pennsylvania. Solveig Padilla and Irene Martinez prepared the camera-ready text and tables at the Academy. Chris McShane edited the report, and Elaine McGarraugh added this report to her growing list of production-editing accomplishments. Susan Lapham drew the map of India and several figures. The committee extends its gratitude to these individuals and institutions for their contributions to the project.

Ansley J. Coale, Chair
Committee on Population and Demography

SUMMARY

India's sheer size--nearly 700 million people were counted in the 1981 census--ensures that developments in India will weigh heavily in any worldwide demographic accounting. Adding interest to demographic developments in India is its position as the first developing nation to endorse family planning programs officially and the variety of forms that birth control programs have taken there. A map of India is on page 14.

Although care must be taken not to accept Indian demographic information at face value, reasonably reliable and robust estimates can be constructed from the available sources. India has a long history of census-taking going back to 1881, although analysis of the data is hindered by poor quality, incomplete national coverage, and irregular tabulation categories; there are also problems of underenumeration and age misreporting. India's civil registration system, which goes back to the 1860s, is plagued by both underregistration and incomplete coverage, making the analysis of trends from these data almost impossible. As an alternative, the Sample Registration System (SRS) was initiated in 1964-65. This is a dual-record system with the main objective of providing reliable estimates of birth and death rates at the national and subnational levels. The SRS, while incomplete and somewhat uneven, provides valuable information on vital rates in India. However, it should be noted that in two states (Bihar and West Bengal), the completeness of sample registration is substantially below the all-India average; these states reported 106 million people in the 1971 census, 19 percent of India's total. In conjunction with the SRS, two surveys have been conducted: (1) a 1972 fertility survey covering 25 percent of the SRS sample areas, which yielded significant

data used in this report to arrive at fertility and mortality estimates and (2) a 1979 survey on infant and child mortality. Finally, the National Sample Surveys (NSS), an ongoing series of socioeconomic surveys conducted on a regular basis since 1953-54, have provided valuable data on children ever born and surviving from which indirect estimates of child and infant mortality could be derived; however, these surveys have been pushed into the background by the SRS, and SRS-NSS comparative studies indicate that the NSS data are affected considerably by the omission of events due to recall lapses and the heavy workload of NSS investigators.

This report draws on the data sources described above to provide estimates both for all-India and for the 15 Indian states with populations larger than 5 million in 1971. Just before this publication went to press, an age distribution from a 5-percent sample of the 1981 census became available for both sexes combined. This age distribution was considered to be too important to ignore, and estimates presented in this volume have been reinterpreted in light of the distribution, which proved to be particularly significant in the concluding chapter.

ALL-INDIA ESTIMATES

Mortality

A major conclusion of the mortality analysis is that a large decline in child mortality, heretofore undocumented, occurred in India during the 1960s. It is estimated that the probability of dying before age 2 declined from .225 about 1961 to .164 about 1968 (the 1968 figure is derived from a 1972 survey). Subsequent data sources suggest that more modest declines in child mortality occurred in the 1970s, although there is inconsistency between sources.

For analyzing adult mortality and crude death rates, the principal source of information is the SRS. The major quality checks available are tests of consistency with observed age distributions and growth rates. These tests suggest that SRS counts of adult deaths are about 10-percent deficient, although a wide range of estimates results from relatively small modifications in the tests. Male deaths appear to be somewhat more completely registered in the SRS than female deaths, and for this report the panel adopted figures of .93 for registration completeness of males and .87 for that of females. Because

it is unlikely that mortality of children is more completely registered than that of adults, the figure of 10-percent underregistration is also used to correct crude death rates. However, the recorded SRS death rates below age 5 are subject to an offsetting bias--age overstatement--that might deprive the age group 0-4 of its lowest-mortality segment. Survey data confirmed the general levels of under-5 mortality recorded in the SRS in the early years of operation and suggest that SRS child mortality levels may be too high by the end of the 1970s. A simulation presented in the final chapter supports the survey results as does (indirectly) the 1971-81 intercensal analysis in Chapter 3. It is likely that a sizable mortality improvement occurred in 1979 because SRS crude death rates declined by 13 percent between 1977 and 1979 and declined again between 1979 and 1980. In general, the estimates presented here are less pessimistic than the conventional depiction of ponderous mortality change in India. The crude death rate for all-India declined from 18.8 in the period 1961-71 to 15.5 in 1971-76, and it continued down to 13.4 in 1976-81.

Fertility

The analysis of fertility is based on the 1972 and 1979 surveys and on SRS data. This analysis is complex because of data inadequacies that could be resolved satisfactorily only at the state level. In particular, marital distributions in the 1972 Fertility Survey are out of line with those in the 1971 census. If appropriate corrections are made, and if reported births in the past year are compared with lifetime births reported in the 1972 survey for each state, the result is a corrected total fertility rate for all-India of 5.60 in 1971-72 and a crude birth rate for the same period of 39.3 per 1,000. These figures, accepted as the most reliable estimates of fertility for the period, imply that SRS births are underregistered by about 7.8 percent for the 1970-73 period. Birth-last-year reports in the 1979 survey are judged to be 6-percent deficient relative to those in the 1972 survey. Our correction of these two surveys is smaller than those of other analysts, and implies that the decline in fertility has been faster than generally believed. This assessment is consistent with--but not wholly independent of--a large drop in the proportion of the population below age 10 between the censuses of 1971 and 1981.

Estimates of Vital Rates for 1961-71

The major method available for estimating vital rates in India before the advent of the SRS or the 1972 and 1979 surveys is intercensal survival analysis. Such analysis of the 1961-71 intercensal period is the principal subject of Chapter 3; a brief intercensal analysis of the 1971-81 period is included based on the 1981 age distribution. While intercensal analyses for 1961-71 have been performed by many others, this report introduces more solidly based information on child mortality than has been used previously. The estimated vital rates for 1961-71 (estimated through mean, forward, and backward survival techniques) are 41.0 for the crude birth rate, 18.8 for the crude death rate, and 5.72 for the total fertility rate (estimated indirectly by using the age pattern of fertility from the 1972 Fertility Survey). Life expectancy at birth is estimated at 46.8 for males and 45.2 for females; life expectancy at age 5 is estimated to be 55.4 for males and 53.7 for females. A comparison of 1961 and 1971 censuses by cohorts, together with an early life table computed from the SRS, suggests that the sex ratio of the 1971 census may have been depressed relative to 1961 by the selective omission of females in 1971.

Summary of All-India Vital Rates

Before the above estimates of fertility and mortality were accepted as final, the data were subjected to two additional tests. The first is a comparison of estimates for the 1971-81 decade against recorded 1971-81 intercensal growth. The crude birth rate for this decade from the SRS (corrected for 7.8-percent underregistration) is 37.4; the SRS crude death rate for the 1971-80 period (corrected for 10-percent underregistration) is 16.3. The implied crude rate of natural increase for the decade is 21.1 per 1,000, compared to the recorded intercensal growth rate of 22.2 between 1971 and 1981. It is believed, however, that the intercensal growth rate might be overstated by perhaps 0.4 per 1,000 by the differential omission of females from the 1971 census, reducing the intercensal growth rate to 21.8 per 1,000 and its difference from estimated natural increase to 0.7 per 1,000.

The second test, which is more complex, involves estimating the true age distribution of India in 1966 and

projecting that age distribution forward to 1981 by age-specific rates of birth and death estimated for various 5-year periods. Two projections were made, using differing levels of mortality because of the inconsistency between survey and sample registration estimates of mortality. Comparison of results to 1971-81 intercensal growth supported the low-mortality scenario.

This second test was deemed more decisive because it uses more information both on the population of India and on formal demographic relationships. Furthermore, it produces an age distribution that, in its basic features, is validated by the 1981 census. It suggests that SRS birth and, especially, death rates need less upward correction to be nationally representative than is implied in the above paragraph. SRS "completeness" seems to improve as the decade progresses, which may reflect deficiencies (increasingly incomplete population base, increasingly unrepresentative areas) as well as virtues.

Combining these pieces of information, the panel offers the following summary of vital rates in India since 1961:

	1961-71	1971-81	1971-76	1976-81
Crude birth rate	41.0	35.9	37.9	34.0
Crude death rate	18.8	14.4	15.5	13.4
Total fertility rate	5.72		5.37	4.69
Life expectancy at birth, females	45.2		49.7	53.1
Life expectancy at birth, males	46.8		51.7	53.7
Probability of dying before age 2	.184		.151	.139

Note: The periods begin with March 1 of the initial year.

Age-specific fertility rates corresponding to these estimates are presented in Chapter 4.

The general picture is one of persistent change. The gain in life expectancy at birth is 7.4 years during a 12-year period, which is a very respectable pace by international standards. However, inconsistency between sources suggests that less confidence should be placed in this conclusion than would otherwise be the case. The sizable decline is supported by child mortality surveys and by intercensal growth, but not by SRS annual rates. A decline in fertility appears to accelerate somewhat during the 1970s, more so for total fertility than for the crude birth rate. The decline in the total fertility rate amounts to slightly more than one child per woman in a period of 12.5 years (1966-78). Thus, the panel estimates that fertility had declined more than is generally believed. The slower change in the crude birth rate probably reflects two factors: an increase in the proportion of females who are of childbearing age, induced by the fertility decline itself; and larger changes in age-specific fertility at higher ages, which receive more weight in calculations of total fertility than of the crude birth rate.

On a regional level, in general, higher mortality and fertility conditions are persistently found in the north than in the south of India; however, there is, perhaps surprisingly, little regional differentiation in recent changes in vital rates. The following section addresses state-specific results, which are the focus for the majority of this report.

STATE ESTIMATES

Mortality

Final estimates of the probability of dying by exact age 2 during the 1960s are shown in the 3 panels of Figure 1 for 15 major states in India. Each panel represents a range of mid-decade estimates; the left panel from .180 in Tamil Nadu to .262 in Uttar Pradesh; the middle panel from .153 in Maharashtra to .166 in Gujarat; and the right panel from .099 in Kerala to .141 in West Bengal. Note the considerable variation among states: during the 1960s, about 9 in 10 children in Kerela survived to the age of 2, while in Uttar Pradesh, only 3 out of 4 survived to this age. Punjab and West Bengal are among the

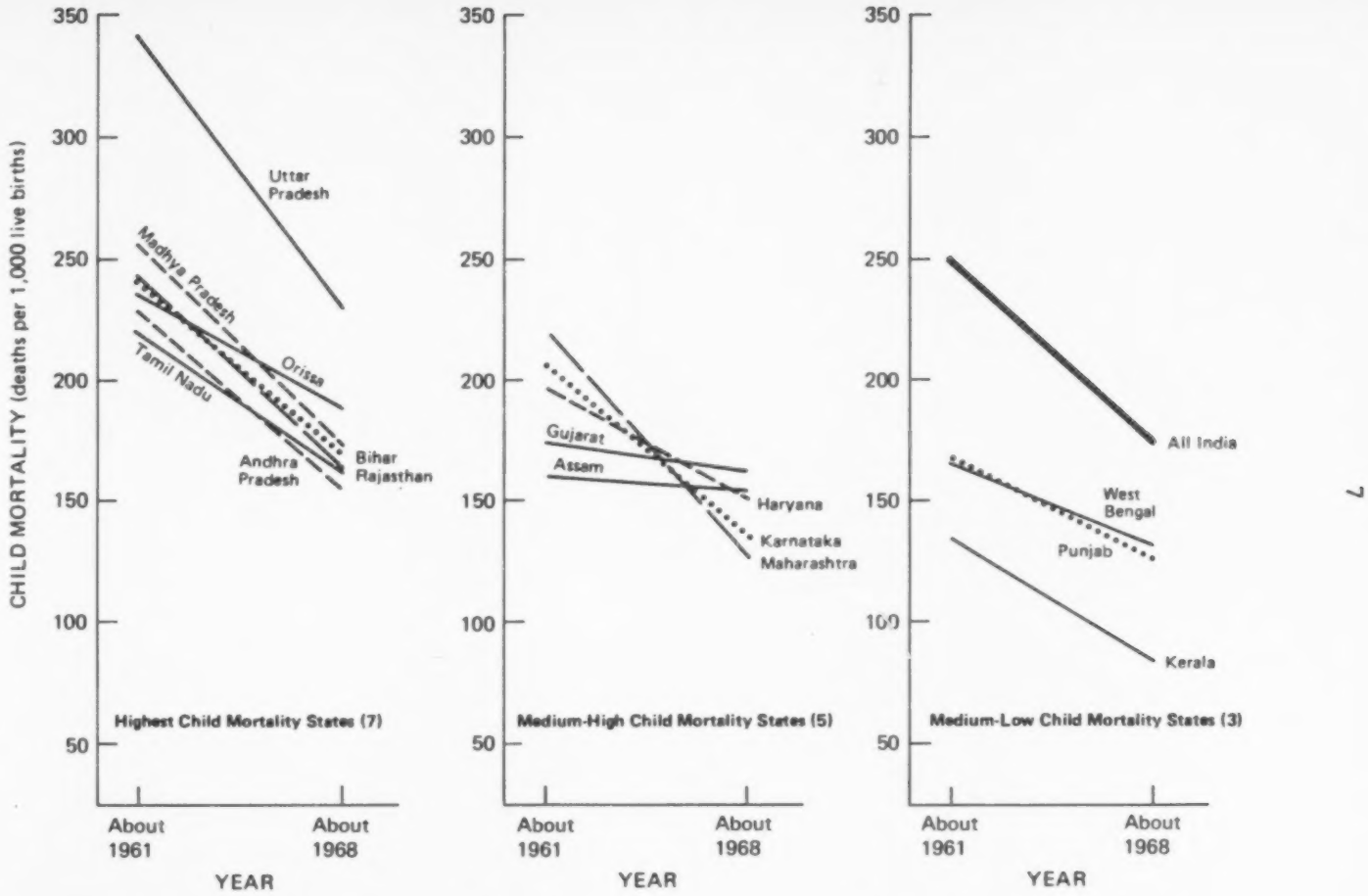


FIGURE 1 Child Mortality: Final Estimates of the Probability of Dying by Exact Age 2, About 1961 and 1968 in 15 States and All-India
Source: Table 17, p. 68.

comparatively lower-mortality states, while Orissa, Madhya Pradesh, Bihar, and Rajasthan are among the higher-mortality states. Figure 1 shows that 13 of these 15 states had substantial declines in the probability of dying by exact age 2 during the 1960s.

Crude death rates are also estimated for the 15 large states for the 1960s and the 1970s. Because infant and child mortality comprise a major part of overall mortality, the pattern for crude death rates among states is similar but not identical to that for child mortality. Figure 2 presents the results in 3 panels, classified by the crude death rate estimate for 1978. The left panel includes 4 states with a range from about 17 to above 20; the middle panel shows 6 states with a 1978 range from about 14 to 16; the right panel shows 4 states with a range of 12 or 13, plus Kerala, which had a crude death rate of about 8 in 1978. The trends in the crude death rates in Figure 2 are based on two major sources of estimates: intercensal analysis for the 1961-71 decade, and death rates produced by the SRS since 1970, corrected for estimated underregistration. For the latter, the completeness is estimated to be .9 throughout the decade and in each state, although there is some suggestion for all-India that completeness may have improved.

The two basic procedures used produce a picture of smoothly declining crude death rates for all-India. Uttar Pradesh, Madhya Pradesh, Bihar, and Orissa are the highest-mortality states in the 1961-71 period, just as they are at the end of the 1970s; Kerala and Punjab have the lowest-mortality rates in all series. Thus there is a north/south gradient in mortality; this is also true for fertility, discussed below, but with some major differences. Orissa in East India, intermediate in fertility levels, clearly belongs with the high-mortality northern groups; Haryana, in the high-fertility northern group, is closer to neighboring Punjab in its low crude death rate.

There is relatively little regional differentiation in death rate trends. The three states with the largest declines in crude death rates in Figure 2, Andhra Pradesh, Uttar Pradesh, and Karnataka, are three of the five states that had an acceleration in intercensal growth between 1961-71 and 1971-81. This correspondence not only helps to confirm the validity of estimated trends in crude death rates but also suggests the important role of changing death rates in accounting for changing patterns of regional growth.

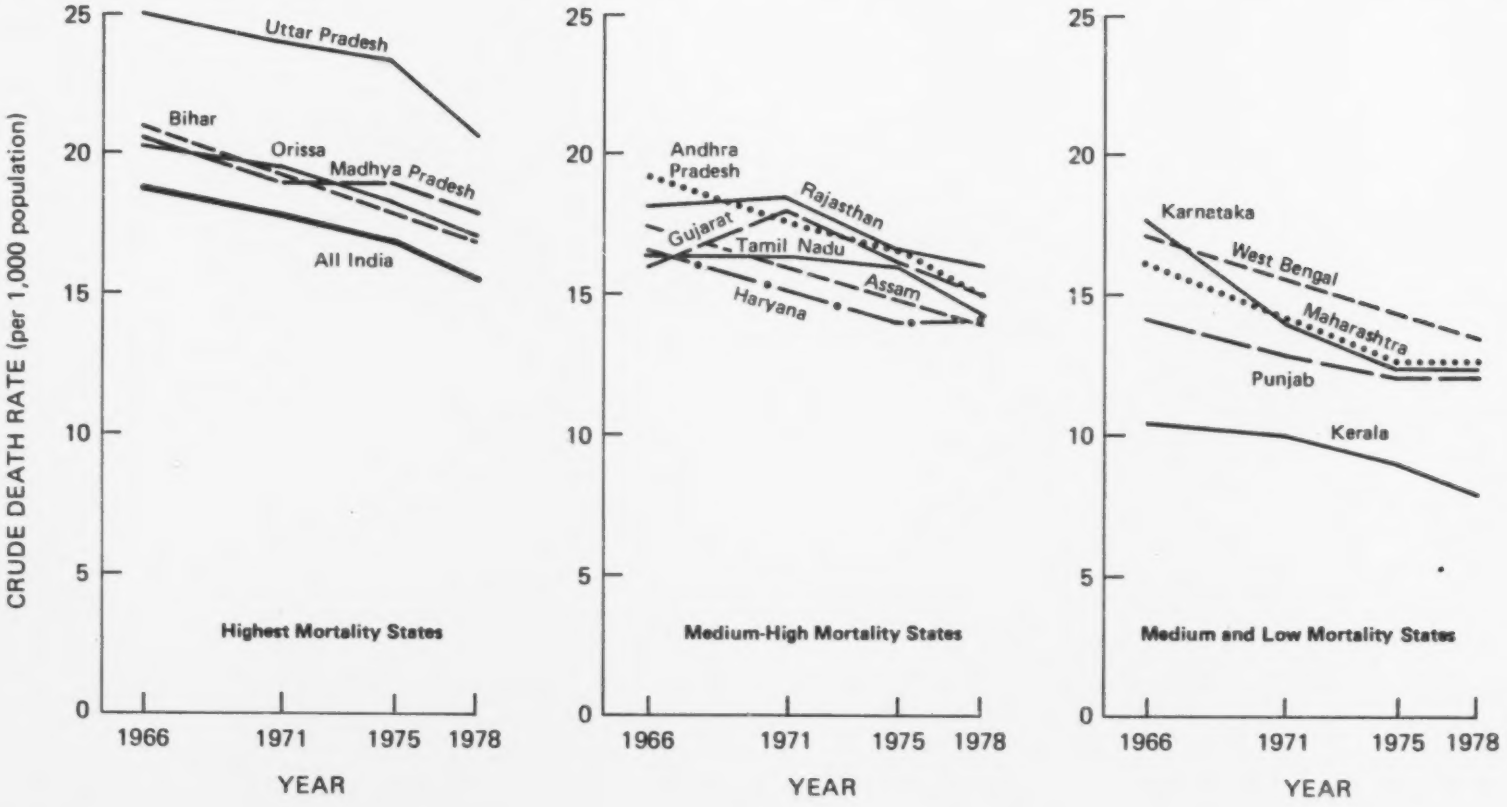


FIGURE 2 Crude Death Rate Trends Between 1968 and 1978 in 15 States and All-India
Source: Table 42, p. 134.

Fertility

Fertility, as measured by the crude birth rate, also varies considerably among states in India: whereas the estimated crude birth rate in 1979 is 40 in Uttar Pradesh, Haryana, and Madhya Pradesh, it is just over 30 in Punjab and Maharashtra, and 28 in Kerala. Figure 3 presents a summary of crude birth rate estimates for approximately 1968 and 1978 for the 15 states of India with populations of 5 million or more. These estimates reflect an extremely wide variety of procedures, and therefore what appear to be trends may simply reflect the differential impact of error, widespread in India, on the results of various techniques. The estimates in Figure 3 are based on the averages of five series presented in Table 39 of the full report, three for the 1960s and early 1970s, and two for 1976 and 1979.

In this regard, it is reassuring to note that there is a very high correlation among the various series. States in northern India--Rajasthan, Haryana, Uttar Pradesh, Assam, and Madhya Pradesh--have birth rates above the mean in each of the five series. The southernmost states--Kerala, Tamil Nadu, Karnataka, Maharashtra, and Andhra Pradesh--are below the means in each of the five series. Bihar resembles the northern group in the three series in which it reliably appears; Gujarat also leans in the northerly direction. Orissa and West Bengal, forming a contiguous area in East India, show no persistent deviation from the all-India averages. Only Punjab violates the north/south dichotomy, being a below-average state in each of the five series by about 4-5 per 1,000. The regional picture also appears remarkably clear in view of the extraordinary diversity of procedures and data used: census age distributions combined with survey estimates of child mortality; fertility survey questions on births in the previous year-end parity; age distributions of population and deaths by age in the SRS; and SRS births corrected by estimates of underregistration.

State birth rate trends are also subject to method-specific error, particularly since the latest two estimates are based on the weakest information (the 1979 estimate using correction factors estimated for 1971-72, while all-India results suggest that the factors should have declined). Nevertheless, a clear impression emerges from Figure 3 that all regions have shared roughly equally in the birth rate decline, although they started from

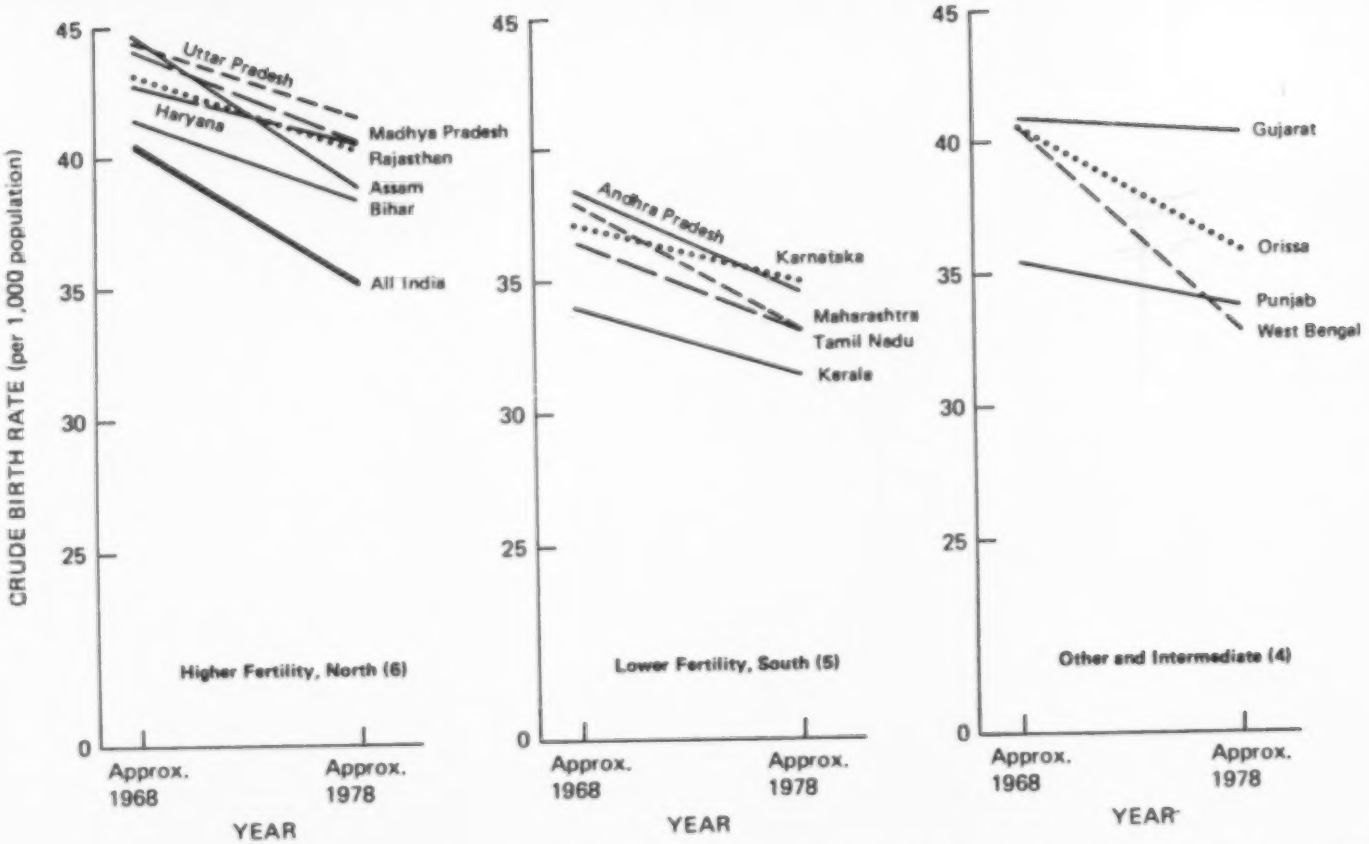


FIGURE 3 Crude Birth Rate Trends Between Approximately 1968 and 1978 in 15 States and All-India
Source: Table 39, p. 129.

different levels. This impression is confirmed in the following summary of changes in the mean crude birth rates in groups of states between approximately 1968 and 1978:

	Mean Crude Birth Rate 1961-71, 1966-71, 1971-72	Mean Crude Birth Rate, 1975-76, 1979	Approximate Decadal Decline
High Fertility, North (6)			
Assam, Bihar, Haryana, Madhya Pradesh, Rajasthan, Uttar Pradesh	43.66	39.97	3.69
Low Fertility, South (5)			
Andhra Pradesh, Karnataka, Kerala, Maharashtra, Tamil Nadu	38.83	33.45	3.38
Other and Intermediate (4)			
Gujarat, Orissa, Punjab, West Bengal	39.39	35.64	3.75

Source: Table 39, page 129.

There is no substantial difference in the pace of decline among the northern, southern, and intermediate groups of states. Of course, there is no assurance that the same factors underlie the trends in various regions. For example, a larger fraction of the decline in the north may be attributable to that region's larger decline in

child mortality and associated age distributional disturbances. It is also possible that SRS completeness deteriorated during the 1970s in the north relative to other regions; a state-specific analysis of intercensal growth 1971-81 indicates that, in Rajasthan and Uttar Pradesh, growth did not decelerate as much as is implied by SRS figures.

While this report also examines total fertility rates (TFR), the estimates are less reliable than crude birth rate estimates because they require information on the age pattern of fertility as well as on its volume. Age reporting in India is not accurate by international standards; in addition, we had only one source of information about the age pattern of fertility by state--the 1972 Fertility Survey. Because of these problems and on the basis of analysis of the TFR estimates by state, the panel concludes that the crude birth rate estimates are substantially more solid because of the multiplicity of sources and methods available for estimating them.

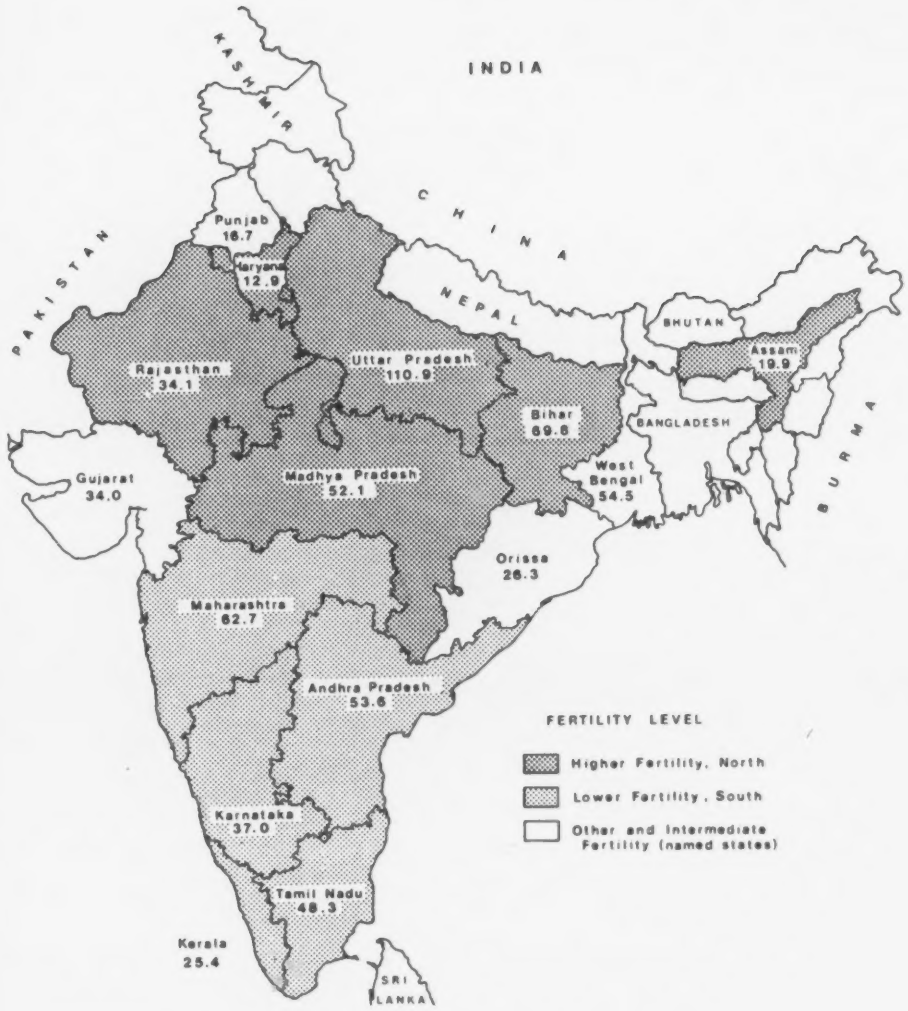
The last-minute availability of state age distributions (both sexes combined) permitted a reexamination of these conclusions in Chapter 4. This analysis confirmed the continuation of a sizable North/South differential in birth rates. It also confirmed the absence of strong regional differentiation in fertility decline. However, it suggested that, just as for all-India, birth rates by state have declined by more than implied by SRS trends during the 1970s.

CONCLUSION

Performing research on the demography of India can be a humbling experience. Pitfalls in Indian data are sometimes obvious and sometimes hidden, and demographic scenarios can be very different depending on how one chooses to correct them. We are impressed by the degree to which demographic analyses in India must be a continuous activity of updating and integrating estimates. We will doubtless have a better picture of the demography of the 1971-81 period in 5 years than we have now, and the temptation is to withhold estimates until they are as well justified as possible. But by then their utility is much reduced. We offer these estimates not as the final word but as the best we can do at present. We are fully aware that a reasonable case could be made for raising recent birth and death rates by several points and that

such a case might be validated sometime in the 1980s by a survey finding higher child mortality.

To the extent that we have been able to reduce the range of uncertainty about Indian demography, our success is largely a product of the availability of overlapping sources of information. While the SRS is performing a valuable service in mapping yearly trends in crude birth and death rates, its products would have far less value if they could not be tested periodically against other information. Particularly important in this regard are surveys asking questions on lifetime births and child deaths. It is not sufficient simply to ask about these matters; the manner in which questions are asked and the data processed are critical determinants of the quality of the results, as illustrated by the comparative quality of the 1972 and 1979 surveys. Furthermore, providing the foundation for all attempts to understand the demography of India are the series of decennial censuses, mounted at great cost in a country in which competition for resources is intense. Even though much of the 1981 census remains to be published, several pieces of evidence derived from it have been a critical factor in establishing the set of estimates presented in this report.



Map of India, with 15 Large States Identified by Population Size (in millions) and Fertility Level

Source of population data: 1981 Census of India, as reported in Census of India, Series 1, Paper 3 of 1981, Provisional Population Totals: Workers and Non-Workers. New Delhi 1983: Registrar General and Census Commissioner for India. For Assam, a projected population estimate is used, since a census was not taken there in 1981.

1 INTRODUCTION

There is no need to stress the importance of India for an understanding of international population trends. Its sheer size--nearly 700 million people were counted in the 1981 census--ensures that developments in India weigh heavily in any worldwide demographic accounting. Its population is about equal in size to that of South America and Africa combined. Were it a separate nation, Uttar Pradesh would rank among the world's 10 largest countries. Adding interest to demographic developments in India is its position as the first developing nation to endorse family planning programs officially, in addition to the variety of forms that birth control programs have taken there.

Because of India's size and regional diversity, the Panel on India elected to make estimates not only for all-India but also for the 15 states with populations larger than 5 million in 1971 (see map). This decision proved to be costly in time, effort, and elegance. But ultimately the regional focus shed light on this neglected feature of Indian demography and improved national estimates by allowing corrections and adjustments to be made on a state-by-state basis. It also permitted examination of the regional consistency of results from different sources and procedures, thereby helping to test the validity of results at the national level.

Any appraisal of India's demographic circumstances should begin with a discussion of the data sources on which the appraisal is based. For a country at its level of economic development, India is unusually well situated with regard to demographic data. One advantage is its long history of census taking. But only in the last 15 years, with the development of the Sample Registration System and the conduct of several sample surveys, have

the data become rich and diverse enough to form a solid basis for estimating vital rates. In this chapter, we review several features of Indian data that are pertinent to the panel's work, with special emphasis on studies of data quality.

1.1 POPULATION CENSUSES

Since the first synchronous census in 1881, the population of India has been counted once every 10 years. This series of decennial censuses is perhaps the single most important source of demographic data in India. In the absence of a reliable civil registration system, the information on the growth and the age-sex structure of the population provided by the census formed for a long period the sole basis of estimation of fertility and mortality. Although some specific questions on fertility and mortality have been asked on a sample basis for certain states in every census since 1911, analysis of the data is hindered by poor quality, incomplete national coverage, and irregular tabulation categories.

The total populations and sex ratios recorded in recent censuses for the current territory of India are shown below:

Year	Population (1,000s)	Sex Ratio (males per 100 females)
1941	318,661	105.8
1951	361,088	105.7
1961	439,235	106.3
1971	548,160	107.5
1981	685,185	106.9*

*Excludes Assam.

Source: India, Registrar General (1975a, 1983b).

The Post Enumeration Check (PEC) surveys indicate that the total counts of the population returned in Indian censuses are quite accurate. The first verification of the census count was carried out after the 1951 census. It showed a net undercount of 1.1 percent (India,

Registrar General, 1953). Similar surveys conducted after the 1961 and 1971 censuses revealed a net undercount of the order of 1-2 percent (India, Registrar General, 1964a, 1975a). However, doubts have been raised about the reliability of these figures, since the PEC surveys suffer from some of the same drawbacks as the population censuses that they attempt to evaluate. Some independent indirect estimates place the level of underenumeration in Indian censuses at higher levels (Coale and Hoover, 1958; Dandekar and Mulay, 1975; Bureau of the Census, 1978; Operations Research Group, 1974).

In estimating the trends and levels of fertility and mortality from census data, the actual level of underenumeration is not as crucial as the relative levels of underenumeration in two consecutive censuses. We present below some evidence that the level of female underenumeration was greater in the 1971 census of India than in the 1961 census. There is reason to believe that the 1971 census may have been subject to greater error than previous censuses because it was upset by elections held in February and had to be postponed until April 1 (Visaria, 1971; Visaria and Visaria, 1981). Age differentials in completeness can also affect estimates of fertility and mortality. Although it has been long suspected that there is relatively more underenumeration of children than of adults in Indian censuses, good data on this subject have become available only for 1971, when results from the PEC survey were tabulated by age. As is clear from Table 1, estimated omission is greater among children than adults; the table also indicates that there is greater likelihood of female children being missed in the census than of male children. The implication of these results for demographic estimation is that the actual age distribution is probably younger than that of the enumerated population; for most census-based procedures, this bias produces an underestimate of fertility levels.

The results of the Post Enumeration Check of the 1981 census have recently been released (India, Registrar General, 1983a). They reveal an undercount of males of 1.710 percent and of females of 1.885 percent. Thus the female undercount figure is almost identical to that of 1971, while the male enumeration completeness is estimated to have deteriorated by about 0.10 percent. Of course, the implied deterioration may simply reflect improvements in the conduct or processing of the post-enumeration check itself.

TABLE 1 Estimated Net Omission Rate (per 1,000) by Age, Post-Enumeration Check Survey, 1971 Census: All-India

Age Interval	Male	Female
0	29.91	45.82
1-4	17.97	20.20
5-14	14.27	15.51
15-34	16.25	18.09
35-44	10.41	8.43
45-59	8.12	14.60
60+	7.72	23.49
All Ages	15.27	18.32

Source: India, Registrar General (1975a).

Another source of error in reported age distributions is age misreporting. Since age is not an important concept for most Indians, the recorded age distributions from Indian censuses suffer from considerable distortions. The ignorance of one's own true age results in a tendency to guess an age that ends in a common or desirable digit. A casual glance at a single year of age distribution from any of the Indian censuses shows that an unusually high proportion of the population report their ages as ending in digits 0 and 5. Digits 2 and 8 are also important centers of concentration, especially at younger ages. The patterns of digital preference are not the same at all stages of the life cycle. Among children, heaping is not too pronounced, probably because they were born recently and there is marked physiological development with age among children and adolescents. As age advances, guessing becomes more difficult and the concentration of the population reporting ages ending with digits 5 and especially 0 increases. The concentration at ages ending with digits 8 and 2 noticeably decreases after early adulthood (India, Registrar General, 1963). Analysis also shows that age heaping is more pronounced among the female population (India, Registrar General, 1963).

TABLE 2 Indices of Digital Preference in the Census: All-India

Indices	1951		1961		1971	
	Male	Female	Male	Female	Male	Female
Whipples Index (range 100 to 500)	247	258	282	294	302	308
Myers' Index (range 0 to 180)	61.4	57.4	75.1	70.7	64.8	68.1

Source: Zlotnik (1979).

In demographic and actuarial literature, two summary measures--Whipple's Index and Myers's Index--are often used to gauge the level of digital preference. Whipple's Index measures the relative preference for digits 0 and 5 in the age range 23-62. If there is no concentration, the index measure is 100, and if everyone reported his or her age only in multiples of 5, the index would be 500. The index proposed by Myers measures the preferences for each of the 10 digits 0-9, and an overall index is calculated by adding, irrespective of signs, 10 individual values. This index could vary from 0 to 180. Table 2 shows the values of both indices derived for the age distributions recorded in the 1951, 1961, and 1971 censuses (the 1981 age distribution had not been released to date). Whipple's Index shows that the concentration of the population reporting ages ending with digits 0 and 5 has increased steadily. The trend indicated by Myers's Index is less clear, but on the whole it seems that the age concentrations in the 1971 and 1961 census returns were greater than those in 1951.

In demographic estimation the effects of digital preference can sometimes be effectively handled by grouping individuals into appropriate age intervals. Systematic errors in age reporting--those that produce systematic over- or understatements of age--often pose considerably greater problems. The presence of systematic errors in age data can be demonstrated in several ways. A traditional method is to compute age and sex ratios. Figures 4 and 5 show age ratios and sex ratios by five-

year age intervals computed from the age distributions returned in the last four censuses. The virtual constancy of the age pattern of these ratios and the fact that they do not shift in a cohort-specific way over the years, strongly suggest the existence of persistent and systematic errors in age reporting. Figure 4 indicates that there is a relative excess of persons in the age intervals 5-9, 25-29, 30-34, 40-44, and 50-54, compared with adjacent five-year intervals. The age pattern of sex ratios in Figure 5 indicates that there is a noticeable excess of males over females in the 10-14 age interval, often a relative deficit of males in the 20-24 age interval, and an excess of males in the age range 35-59. Similar results are revealed by intercensal comparisons of the size of cohorts (Ewbank, 1981) and by comparison of census age distributions to model stable or quasi-stable distributions (Coale and Demeny, 1967).

None of the methods for detecting systematic errors in age reporting can distinguish the errors caused by differential omission by age from those caused by misstatement of age. A unique opportunity for making this distinction for children is presented by the Census Evaluation Study (India, Registrar General, 1977c). The purpose of this study was to carry out an independent check of census returns by matching them with Sample Registration System records on births in the years preceding the census. The adjustment factors for each age derived from these data are shown in Table 3.

Adjustment factors greater than unity for omission confirm that a large number of children are not enumerated in the census. Contrary to results of the PEC survey, these data show that male children are more likely to be omitted than females. The adjustment factors for age misstatements indicate that a considerable number of zero- and one-year-olds were reported in higher ages in the census. The report on this study also mentions that about 6.1 percent of males and 4.2 percent of females ages 0-4 were enumerated in the 5-9 age interval in the census. If omissions in the 0-2 age interval are any indication of the extent of underenumeration in the 0-4 age interval, then the omission of children seems to be a more important reason than overreporting of age for the normally observed deficit in the 0-4 age group.

Some additional insights into the pattern of age misreporting in India can be obtained from a study by Dandekar (1966). She matched the age returns of the population of a small town in the 1951 and 1961 censuses

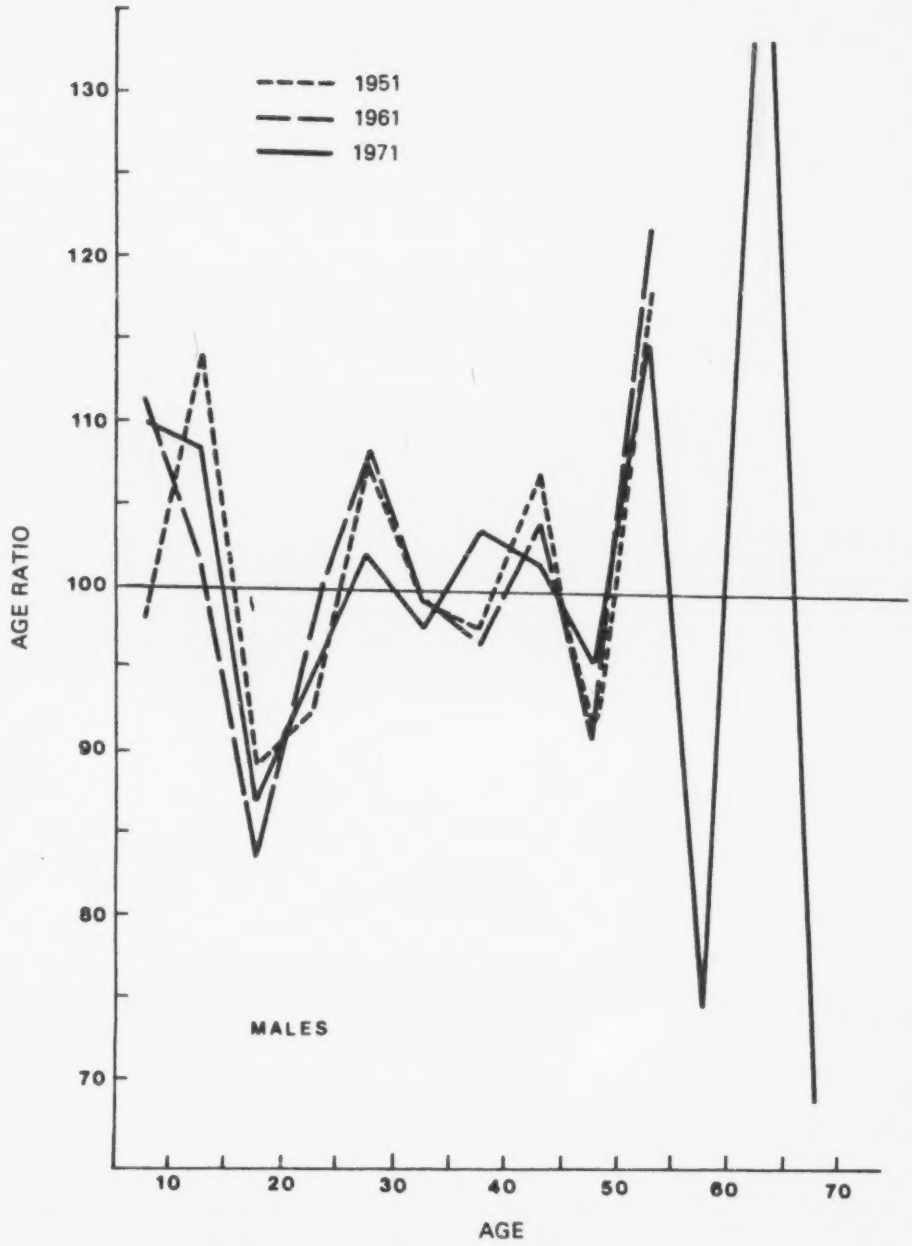
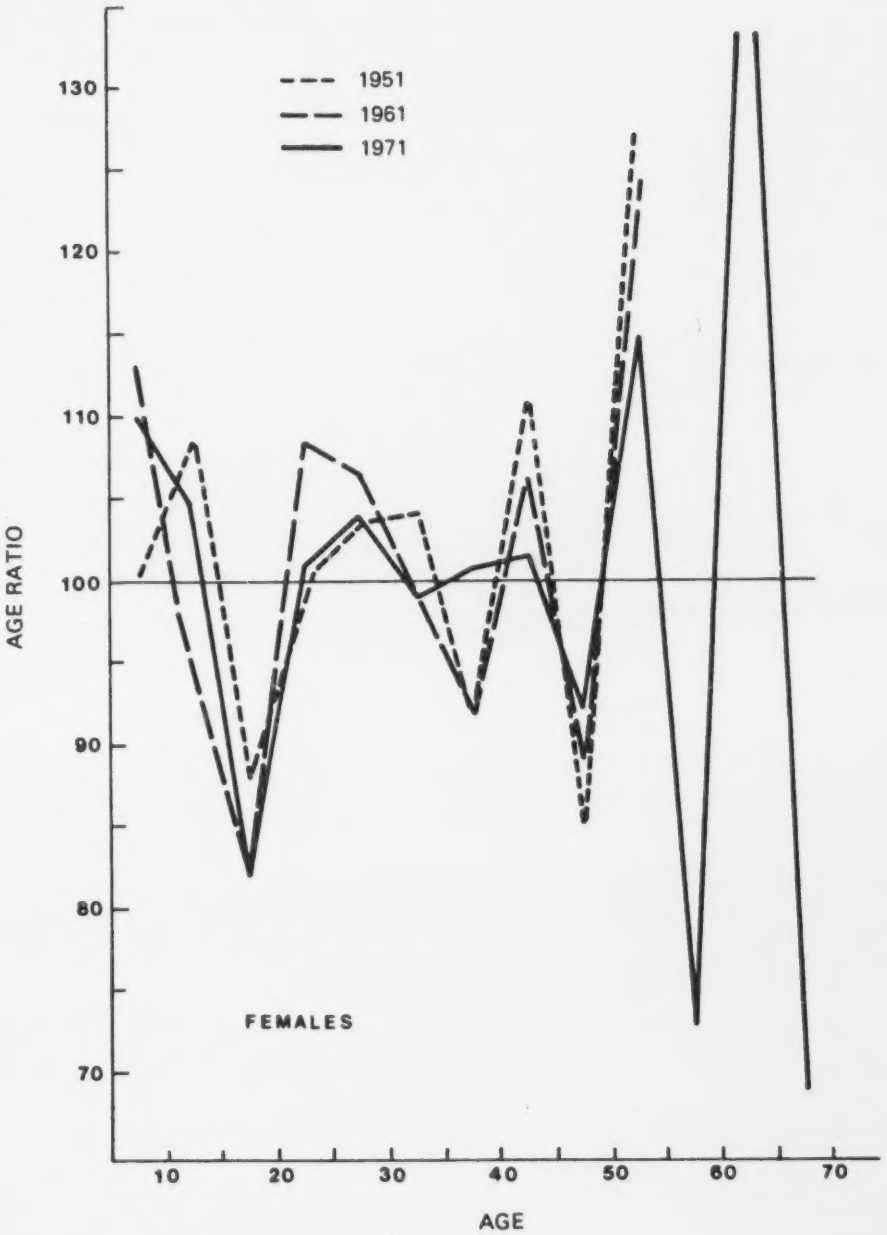


FIGURE 4 Age Ratios, Males and Females

FIGURE 4 (continued)



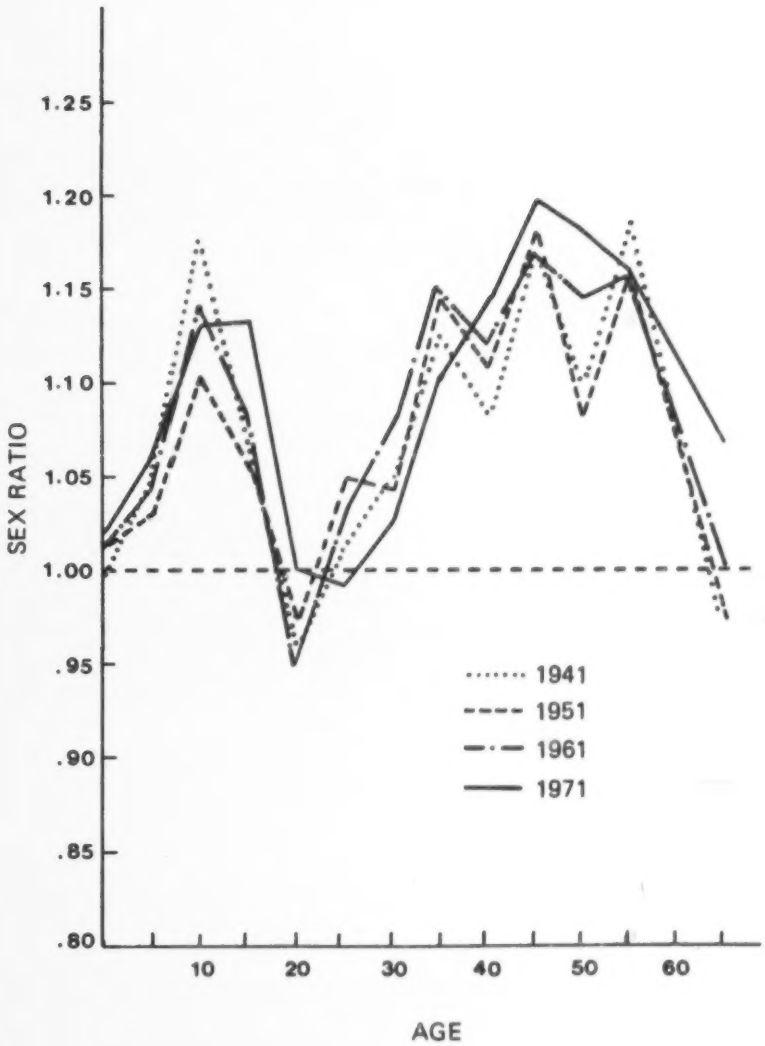


FIGURE 5 Sex Ratios for Different Censuses

(Table 4). A person's exact ages were not known for either of the census dates, only that the difference between them should be the 10 years between the censuses. Table 4 demonstrates that the proportion of persons aged x to x + 5 in 1951 who were also reported to be ages x + 10 to x + 15 in 1961 steadily declines as age advances, consistent with the hypothesis that guessing

TABLE 3 Adjustment Factors for Age Misstatement and Omission, Census Evaluation Study, 1971: All-India

Age Reported in the Census	Factors for Adjusting Age Misstatements		Factors for Adjusting Omissions	
	Male	Female	Male	Female
0	1.040	1.013	1.170	1.152
1	1.345	1.332	1.225	1.213
2	0.868	0.899	1.104	1.076

Source: India, Registrar General (1977c).

age becomes more difficult as a person becomes older. The table also shows that both overreporting and underreporting of age increase as age advances and that at any age interval the underreporting tendencies are stronger. This pattern would imply that, for both males and females, the proportion under any age would be overestimated in the recorded population, except possibly at age 30, around which the two opposing tendencies may cancel. This implication, however, does not conform with conclusions from stable population analysis, perhaps because of the differential omission of children in the census.

The results shown in Table 4 have some disturbing implications for the estimation of adult mortality from the forward projection method described by Coale and Demeny (1967). The ratios of population above age x in 1961 to the population above age x - 10 in 1951 were computed from the Dandekar study (see Table 5). Since we are dealing with age distributions of matched persons who survived from 1951 to 1961, the survival ratio should be unity. The deviations from unity of the computed ratios are therefore pure measures of age distortions. As Table 5 shows, the ratios are less than 1.0 with very few exceptions. The implication is that the forward projection method would tend to underestimate life expectancy levels. However, since Dandekar's study is based on a small sample of matched individuals, without further confirmation from other studies it is injudicious to generalize this conclusion to all-India.

TABLE 4 1951 and 1961 Census Age Returns Matched for a Small Town in Maharashtra: India

Reported Age in 1951 x to x+5	Male				Female			
	Number in 1951	Percent Who Reported Age in 1961			Number in 1951	Percent Who Reported Age in 1961		
		< x+10	x+10-x+15	>x+15		< x+10	x+10-x+15	>x+15
0-4	309	11	81	8	291	23	75	2
5-9	341	34	56	10	127	61	32	7
10-14	222	26	53	21	88	21	52	27
15-19	144	24	58	19	144	28	48	24
20-24	132	32	52	16	136	43	38	19
25-29	101	37	39	25	161	40	35	25
30-34	111	50	24	26	154	48	31	21
35-39	119	38	30	32	159	42	32	26
40-44	130	49	31	20	157	43	24	34
45-49	129	45	28	27	98	44	23	33
50+	243	12	88	--	159	8	92	--
Total	1,981				1,644			

Source: Computed from Dandekar (1966).

TABLE 5 Ratios of the Population of Cohorts Above Certain Initial Ages in Two Successive Censuses, Based on Intercensal Matching Study in Maharashtra: India

Age in Later Census	Male $C^{61}(x) / C^{51}(x-10)$	Female $C^{61}(x) / C^{51}(x-10)$
10	.983	.959
15	.943	.947
20	.983	.993
25	1.015	.988
30	.990	.950
35	.965	.923
40	.937	.917
45	.923	.897
50	.888	.918

Source: Table 4.

We have discussed the problem of using census age distributions in demographic estimation. Indian census authorities have also tried to collect direct information on fertility and mortality. Special inquiries on the fertility of couples began with the 1911 census when some information was collected on a voluntary basis in the Central Provinces and Berar. In 1921 the coverage was extended to five more provinces/states, and in 1931 the entire Indian Union was brought under the inquiry; however, the choice of persons to whom the questions were asked was left to the discretion of the enumerators. It is believed that they tended to ask these questions disproportionately of members of large families. A large number of turned-in slips had to be discarded because they were incomplete, duplicates, or unintelligible. It has been concluded therefore that these data are not

helpful in the estimation of fertility levels (Ghosh, 1940; Das Gupta et al., 1955), yet the data on proportion of surviving children may not have been severely affected by these biases. Unfortunately, the required tabulations were not made, except for two provinces in 1921.

In 1941 the questions on fertility and mortality became compulsory and were not asked on a sample basis, as in earlier censuses. Due to the interruption of World War II, however, many provinces failed to tabulate these data. In 1951 special questions on fertility and mortality were asked in the states of Madhya Pradesh, Travancore-Cochin, and Bihar. The tabulated data from Bihar were never published. Some information on fertility and mortality collected during the training program for census enumerators in 1950 was published in the 1951 West Bengal census volume. The failure of the enumerators to separately record zero parity or parity not stated seems to have reduced the utility of 1951 census fertility data (El-Badry, 1961). In a 1961 census fertility inquiry, some valuable data on fertility and mortality were collected, but the tabulations were restricted because of financial and time constraints. In the 1971 census, the only information collected related to births in the last year, tabulated in wide and irregular age intervals. Since the quality of collected ferility data seemed to be very poor (e.g., Dyson, 1979b), no attempt was made to estimate fertility levels on the basis of these data.

1.2 CIVIL REGISTRATION

The history of registration in India dates back to the 1860s, when statistics on deaths began to be collected as a result of efforts of the Sanitary Commissioners of the government of India. Excellent accounts of the development of vital registration in India are available elsewhere (e.g., India, Director General of Health Services, 1959; India, Registrar General, 1972a) and need not be repeated here. What concerns us here is the completeness of vital registration. The system continues to be plagued by both underregistration and incomplete coverage. The population in areas not under compulsory registration is estimated to be only about 1.5 percent of the total, but the noninclusion of data from defaulting registration units reduces the extent of population coverage at the national level to about 70 percent (India, Registrar General, 1972a, 1978). The coverage is especially poor

in the rural areas of Rajasthan, Bihar, and Uttar Pradesh and only moderate in West Bengal, Karnataka, and Andhra Pradesh. Comparison of rates with those derived by the Sample Registration System indicates that the extent of underregistration is about 40-50 percent at the national level with wide variations among the states (India, Registrar General, 1978). States with more complete registration systems are Punjab, Maharashtra, and Tamil Nadu. There is no clear-cut difference between the completeness of birth registration and that of death registration. There are also indications from intercensal population analysis that the registration system, instead of improving, has been deteriorating (Mehrotra, 1968; India, Registrar General, 1964b). Estimates of underregistration for the period 1941-50 are lower than estimates for more recent periods.

This pattern makes the analysis of trends from civil registration data almost impossible. According to one observer (Ghosh, 1956), the large increase in population was an important factor in the deterioration of civil registration as it increased the work load of the village headman or chowkidar (watchman) responsible for registration work. The fact that provinces with rapid increases in population also recorded maximum reductions in their registration-based birth rates (Ghosh, 1956) has added considerable weight to the argument. Since the mid-1950s the reorganization of states and subsequent attempts to unify varying provisions existing in different parts of the state have apparently led to its further deterioration (India, Registrar General, 1964b, 1966). The Panchayats, village-level civic bodies that took over the work of registration in most states, had neither the necessary personnel nor the zeal to undertake the arduous task. With no sign of quick recovery in sight, the Registrar General of India introduced the Sample Registration System as an alternative.

1.3 SAMPLE REGISTRATION SYSTEM

The Sample Registration System in India (SRS) is a dual-record system with the main objective of providing reliable estimates of birth and death rates at the national and subnational levels. The SRS was initiated by the Registrar General on a pilot basis in a few selected states in 1964-65 and was expanded rapidly to cover almost the entire country by 1971.

The field investigation of the SRS consists of continuous enumeration of births and deaths by an enumerator and an independent survey every six months by an investigator-supervisor. A complete listing of houses and households is made by the enumerator, which is updated at each half-yearly survey by the investigator to obtain the current population. An enumerator (recorder), usually a schoolteacher resident in the area, is appointed for each sample unit and is paid a small honorarium for this work. He is expected to record the births and deaths occurring in the sample area as well as those occurring to usual residents of the sample area who are temporarily outside it. Events occurring to visitors within the sample area are also noted but are not considered for computing vital rates. Thus the events to be recorded by the enumerator include: usual resident present in the sample unit (URP); usual resident absent from the sample unit (URA); and visitors living in the sample unit (V). For ensuring complete recording of events, the enumerator uses several means to keep informed about the occurrence of events in the sample area. These include an informant system in which the enumerator consults a village dai (midwife) or a chowkidar (village priest), who reports the occurrence of events. The enumerator is expected to maintain a list of pregnant women, make house-to-house visits in urban areas and quarterly rounds in rural areas, and make visits to hospitals, primarily health centers and burial grounds.

The investigator conducts the six-month retrospective survey in January and July of each year. He is expected to list all births and deaths pertaining to usual residents (both URP and URA) and to visitors (occurring within the sample unit) during a fixed period of six months. Simultaneously he updates the household population listed in the household schedule by adjustment for births, deaths, and migration. He also pays periodic visits to the sample unit to supervise the work of the enumerator and to provide necessary guidance and clarifications.

After the completion of the six-month survey, the two sets of records of the enumerator and the investigator are matched event-by-event at the state or district headquarters and classified as matched, partially matched, or unmatched. Criteria for matching are agreements on location of the household, the name of the head of the household and name of the mother for births and the name of the deceased for deaths, residential status

(URP/URA/V), sex, and month of occurrence of the event. After the initial matching, the partially matched and unmatched events are reverified in the field to determine the correct allocation. The reverification is generally done by an independent official. Thereafter, an unduplicated count of births and deaths is obtained. No attempt is made to estimate the number of events missed by both the enumerator and the supervisor. The SRS operates in 3,700 sample units selected from the 1961 census frame, of which 2,400 are rural areas. It covers a population of 4.2 million, representing about 0.7 percent of the rural population and 1 percent of the urban population. In 1976-77, another 1,700 sample units were added from the 1971 census frame to the existing sample units with a view to increasing the precision of the estimates. The total population covered in 1981 was over 5.7 million (Padmanabha, 1981).[1]

In recent years the SRS has become the most important source of demographic information in India. Much of this report in effect constitutes an evaluation of how well it is performing, since it contains comparisons of SRS-based estimates with those derived from other sources. Like any data system, the SRS is subject to many kinds of errors. According to the Registrar General (Padmanabha, 1981:18):

> Among the causes that contribute to non-sampling errors in the SRS may be mentioned the fact that some of the sample units are not easily accessible which often results in the enumerator attempting to avoid carrying out the survey in full, lack of rigor in supervision due to the survey deteriorating into a routine which, incidentally, also affects training, the ennui of the enumerator over a period of time due to the long retention of a given sample and the decrease in the interest of the household itself due to the constant visits of the enumerator. The non-sampling errors that arise due to these contributory causes cannot be quantified but do have an effect on the quality and, consequently, the results of the survey.

It seems worthwhile at the outset to summarize the results of direct attempts to evaluate the completeness of the SRS reports. Table 6 is a synopsis of the six main investigations whose results have been published. A wide range of SRS omission rates is indicated; however,

TABLE 6 Summary of Direct Evaluations of the Completeness of SRS Records of Births and Deaths: Selected States and Areas of India

Area	Dates	Percentage of Events Omitted by SRS		Comments
		Births	Deaths	
Kerala	1966-67	8.0	5.0	Showed omissions to be greater in larger villages
Kurnool District (Andhra Pradesh)	1968	2.0	0.0	Covered only area of about 3,000 population for 6 months
Jammu and Kashmir	1968	13.3	7.5	Omission overstated relative to standard SRS procedures because it refers to events missed by enumerators; there was no half-year survey by supervisors
Assam	1972 Rural 1972 Urban	2.4 5.8	3.4 5.2	Showed "usual resident absent" births and deaths to be at somewhat higher risk of omission in rural areas than "usual resident present"
Andhra Pradesh--Urban	1973-74	7.7	9.2	Conducted during period of SRS disruption. Showed one-half of missing births were from "usual resident absent"
Karnataka	1977	18.7	9.9	Comparison data not strictly comparable to SRS but based on non-random sample of health districts using dual-record system with very low match rate.

Sources: Kurup (1968); Sastry and Raju (1968); Gani and Kalla (1969); Puri (1974); Lal and Swamy (1976); Shariff et al. (1979).

the two studies showing the largest omission rates are of questionable relevance. The study of Jammu and Kashmir investigated an early form of the SRS in which all data were gathered by enumerators; there was no half-yearly survey by supervisors. In fact, for all-India during 1970-72, the supervisor alone uncovered 11.8 percent of the total recorded rural births and 11.7 percent of the deaths (India, Registrar General, 1973), which are roughly equivalent to the omission rate in the Jammu and Kashmir study of the SRS. The study in Karnataka was not a direct inquiry into SRS villages but was based on primary health centers. It is not clear what steps, if any, were taken to ensure comparability to SRS villages. Furthermore, the study, using a dual-record design, achieved an extremely low match rate of 41 percent for births and 24 percent for deaths, which reduces the reliability of results.

One of the other studies, in urban Andhra Pradesh, was conducted explicitly to investigate the extent of deterioration in the SRS coverage during 1973-74. In 1973 the regular half-yearly survey for July-December was postponed and conducted at the same time as the half-yearly survey for January-June 1974. At about the same time, SRS local budgets came under increased stress, which may have inhibited (e.g., through transport restrictions) the enumeration of vital events. In addition, a vigorous sterilization campaign in 1973 may have reduced the incentive of field workers to report births. Thus, the omission rates of 8 percent for births and of 9 percent for deaths may not be typical of other periods, although they surely suggest caution in dealing with rates for the 1973-74 period. The remaining three studies of SRS performance indicate omission rates for births ranging from 2-8 percent and for deaths from 0-5 percent. There is, of course, no guarantee that these studies uncovered all of the vital events that occurred. And birth and death rates can also be overstated to the degree that the population at risk is underestimated.

Initially there also was a plan to conduct once every 3 years a comprehensive fertility survey in the sample registration units during the regular half-yearly surveys. So far, however, only one such survey was conducted, in 1972, and this report makes extensive use of the results of that retrospective inquiry in arriving at estimates of fertility and mortality levels in India. The 1972 Fertility Survey was conducted in 25 percent of the households in the SRS sample villages and urban blocks

and covered 0.23 million ever-married women (India, Registrar General, 1976b). Although no information was gathered on detailed pregnancy histories of the women, significant data were collected to study levels and differentials in fertility and child mortality. In the beginning of 1979, a survey on infant and child mortality was conducted on 2,338 rural sample units of the SRS and 1,328 urban blocks. A total of 4.187 million people were included in the area sampled. An advance report based on a 25-percent sample of the areas included was available at the time of the writing of this report (India, Registrar General, 1980a). It contained data useful for both fertility and mortality estimation, although the questionnaire design was less satisfactory for both than was the case for the 1972 Fertility Survey.

Analysis done for the panel as well as the Registrar General's own evaluation suggests that completeness of sample registration is substantially below the all-India average in Bihar and West Bengal. These states reported 106 million people in the 1971 census, 19 percent of India's total. It was necessary in many of the tables in this report that are based on SRS data to exclude these states; an adjustment is made for the effects of this exclusion at the all-India level.

1.4 NATIONAL SAMPLE SURVEYS

The National Sample Surveys (NSS), an ongoing series of socioeconomic surveys, have collected information on births and deaths during some specified time period through retrospective single-round interviews on a more or less regular basis since its seventh round, in 1953-54. Prior to the inception of the SRS, the NSS-based estimates played a significant role in the formulation of such national policies as the five-year plans. A detailed account of the demographic data collected in various rounds of the NSS is available in Das and Bhattacharya (1977).

In recent years, the introduction of the SRS has pushed NSS demographic inquiries into the background. Although NSS estimates of demographic indices are markedly better than those from the civil registration system, NSS-SRS comparative studies indicate that the NSS data are affected considerably by the omission of events due to recall lapse and the heavy work load of NSS investigators (India, Registrar General, 1972b).

In several rounds, however, the NSS has collected valuable data on children ever born and children surviving from which indirect estimates of child and infant mortality levels could be derived. The questions on these were first incorporated into the NSS schedules in the 16th round (1960-61), and information on these were obtained as well as other demographic particulars in every round through the 23rd (1968-69). Unfortunately, however, the tabulation of these data was done only twice--for the 16th (urban India only) and the 20th rounds (India, Cabinet Secretariat, 1967; India, National Sample Survey Organisation, 1975). Information available from the 20th round (1965-66)--which to our knowledge had never been examined--proved to be an extremely important ingredient in the set of estimates included in this report. Using a self-weighting design at the state level, this survey covered a total of about 154,000 households in rural areas and about 93,000 households in urban areas of India.

It should be noted that state-level estimates made for the panel did not in general prove satisfactory for the years before 1961. Demographic information from sources other than censuses was usually not sufficient to provide a strong test of census-based estimates, and the latter did not possess the internal consistency and coherence that would allow them to stand alone. Therefore, the panel's estimates in general are based on data beginning with the 1961 census. Earlier data are sometimes introduced, particularly in the section in Chapter 2 on infant and child mortality, to help resolve disagreements between later data sources.

Unfortunately, the full results of the 1981 census are not available at this time. These results will be very important for understanding the general level of vital rates during the 1971-81 decade. However, the results that are available from the 1981 census--sex ratios and growth rates, for example--have played an important role in several parts of the analysis. The age distribution for a sample of the population became available only as this volume went to press, so it was not possible to integrate the distribution fully into the analysis; however, its message was instrumental in guiding our choice among competing alternatives.

1.5 SUMMARY OF ANALYSIS

This report first considers estimates of infant and child mortality because these are important ingredients in estimates of other demographic parameters. Estimates derived from two fertility surveys conducted during the 1970s are compared with those developed from the National Sample Surveys in the 1960s as well as to death rates produced through the Sample Registration System. Data drawn from earlier censuses were used to test the validity of results, and a variety of internal consistency checks were also employed.

The major conclusion, heretofore undocumented, is that a large decline in child mortality occurred during the 1960s. It is estimated that the probability of dying before age 2 declined from .225 about 1961 to .164 about 1968. The 1968 figure is derived from a 1972 survey. A 1979 survey shows a continued rapid decline in child mortality to a q(2) of .125-.143 (for approximately 1975), but such a large decline is inconsistent with other available information, particularly age-specific rates derived from the SRS. Latest SRS figures show probability of dying before age 1 of .131 in 1976-77 (compared with .132 in 1970-72) and a death rate below age 5 of .0509 in 1977 (compared with .0546 in 1970-72). The choice between these alternatives could not be made with any confidence until the census age distribution was released, and it supported the survey results.

Section 2.2 in Chapter 2 addresses the quality of information available on SRS adult mortality and crude death rates. The major quality checks available are tests of consistency with observed age distributions and growth rates. These tests suggest that SRS counts of adult deaths are about 10-percent deficient, although a wide range of estimates results from relatively small modifications in the tests. Male deaths appear to be somewhat more completely registered in the SRS than female deaths, and in this report we adopt figures of .93 for registration completeness of males and .87 for that of females. It is unlikely that mortality of children is more completely registered than that of adults, so the figure of 10-percent underregistration is also used to correct crude death rates. However, the recorded SRS death rates below age 5 are subject to an offsetting bias, that of age overstatement that might deprive the age group 0-4 of its lowest-mortality segment. In the early part of the 1970s, survey data confirm the general

levels of under-5 mortality recorded in the SRS. Therefore, in producing life tables from SRS data, no corrections were made below age 5. Life expectancy at birth for all-India (except Bihar and West Bengal) based on corrected SRS data for 1971-73 is 48.5 years for males and 46.2 for females (Table 43). Corresponding figures for 1977 are 49.8 and 47.6, showing very little change over that 6-year period. It is likely, however, that a sizable improvement occurred in 1979 because SRS crude death rates declined by 13 percent between 1977 and 1979. Male life expectancies at age 5 are 56.1 years in 1971 and 57.0 in 1977, and corresponding female values are 55.0 and 56.1.

Section 2.3 in Chapter 2 deals with fertility estimation from the 1972 and 1979 surveys and from SRS data. The analysis is complex for reasons related to data inadequacies, which could best be mitigated at the state level. In particular, marital distributions in the 1972 Fertility Survey are out of line with those in the 1971 census. Making appropriate corrections and comparing reported births in the past year with lifetime births reported in the 1972 survey for each state produces a corrected total fertility rate for all-India of 5.60 in 1971-72 and a crude birth rate for the same period of 39.3 per 1,000. These are accepted as the most reliable estimates of fertility for the period. They imply that SRS births are underregistered by about 7.8 percent for the 1970-73 period. Assuming that this correction factor applies throughout the decade to SRS birth rates produces a crude birth rate of 36.0 in 1979, the latest year for which figures are available. However, there is some indication that SRS "completeness" may have improved during the 1970s, so that the 1979 figure should be lower.

The 1979 survey does not appear to produce a plausible fertility level. The crude birth rate in the survey is lower than that in the uncorrected SRS figures. The reported total fertility rate of 4.30 is far out of line with the 5.60 estimate for 1971-72, particularly in view of the more modest declines in SRS crude birth rates. The inadequacies of the 1979 survey probably result from the manner in which fertility questions were asked, the failure to include births omitted by the enumerators but counted by supervisors, and the population's suspicions about the motives for asking questions about fertility.

However, we believe that a reasonable correction of the 1979 survey is possible by a direct comparison of mean parities and mean births-last-year in the 1972 and

1979 surveys. This comparison suggests a total fertility rate of 4.69 for 1978. Such analysis of the 1961-71 intercensal period is the main subject of Chapter 3. The later period could only briefly be examined through intercensal analysis because of the late arrival of the 1981 age distribution. Intercensal analyses for 1961-71 have been performed by many others. What is new about the present version is the introduction of more solidly based information on child mortality than was used before. The estimated vital rates for 1961-71 (mean of forward and backward survival) are 41.0 for the crude birth rate, 18.8 for the crude death rate, and 5.72 for the total fertility rate (estimated indirectly by using the age pattern of fertility from the 1972 Fertility Survey). Life expectancy at birth is estimated at 46.8 for males and 45.2 for females. Life expectancy at age 5 is estimated to be 55.4 for males and 53.7 for females. A comparison of 1961 and 1971 censuses by cohorts, together with an early life table computed from the SRS, suggests that the sex ratio of the 1971 census may have been depressed relative to 1961 by the selective omission of females in 1971.

Before accepting the estimates in Chapters 2 and 3 as final, we have subjected them in Chapter 4 to two additional tests. The first is a comparison of estimates for the 1971-81 decade to recorded 1971-81 intercensal growth. The decadal crude birth rate from the SRS (corrected for underregistration) is 37.4; the SRS crude death rate for the 1971-80 decade, corrected for underregistration, is 16.3. The implied crude rate of natural increase for the decade is 21.1 per 1,000, compared to the recorded intercensal growth rate of 22.2 between 1971 and 1981. It is believed, however, that the intercensal growth rate might be overstated by perhaps 0.4 per 1,000 by the differential omisson of females from the 1971 census, increasing the consistency between our estimates of vital rates and the observed intercensal growth rate.

The second test is more complex. It involves estimating the true age distribution of India in 1966 and projecting that age distribution forward to 1981 by age-specific rates of birth and death estimated for various five-year periods. Two projections were made with differing levels of mortality because of the inconsistency between survey and sample registration estimates of mortality. Comparison of results to 1971-81 population change supported the low-mortality scenario.

NOTE

1. According to a recent announcement (Registrar General's Newsletter, January 1982), about 58 percent of the old sample units based on the 1961 census have been replaced by new sample units drawn from the 1981 census frame, effective January 1, 1982.

2 ESTIMATES BASED ON THE SAMPLE REGISTRATION SYSTEM AND SURVEYS

2.1 INFANT AND CHILD MORTALITY

Estimation of infant and child mortality is a convenient point of entry into the total estimation process, since several other aspects, especially intercensal analysis, are heavily dependent on it. There are three sources of information on infant and child mortality by states in India that provide a relatively firm basis for estimation. One is the Sample Registration System which has a permanent machinery for the enumeration of vital events. The other two are the 1972 Fertility Survey, conducted in SRS villages by SRS field staff, and the 20th round of the National Sample Survey (1965-66). Both of the latter permit indirect estimation of infant and child mortality since they inquire of women the number of children ever born to them and the number surviving to the time of the interview. An additional source of data is available only at the all-India level: the Survey of Infant and Child Mortality, carried out on the eve of the International Year of the Child, again using SRS villages and machinery (India, Registrar General, 1980a, 1980b).

2.1.1 Sample Registration System

Unadjusted data from the Sample Registration System are presented in Table 7. Data for 1973 and 1974 are omitted because of evidence that the SRS performance during those years was below standard. It should also be borne in mind that the SRS was just beginning in some areas in 1970-72 and that data for these years may be liable to greater error than those for later dates, particularly for infant mortality. Thus the registered rise in infant

TABLE 7 Infant and Child Mortality Data from the Sample Registration System: Selected States and All-India

State	Annual Mean, 1970-72		Annual Mean, 1975-76		Percentage Change, 1970-72 to 1975-76	
	Infant Mortality Rate	Death Rate Ages 0-4 ($_5M_0$)	Infant Mortality Rate	Death Rate Ages 0-4 ($_5M_0$)	Infant Mortality Rate	($_5M_0$)
Andhra Pradesh	112	45.0	121	49.1	+8	+9
Assam	134	50.2	134	46.4	0	-8
Gujarat	142	63.7	150	56.8	+6	-11
Haryana	81	31.9	111	45.8	+37	+43
Himachal Pradesh	122	--	121	--	-1	--
Jammu and Kashmir	76	21.9[a]	68	33.4	-10	+52
Karnataka	95	36.9[b]	85	28.6	-11	-22
Kerala	58	24.6[b]	55	19.4	-5	-21
Madhya Pradesh	145	35.3	145	36.0	0	+2
Maharashtra	101	40.8	87	33.1	-14	-19
Orissa	130	57.1	138	53.5	+6	-6
Punjab	107	40.4[b]	103	35.9	-4	-11
Rajasthan	128	60.2[a]	148	60.8	+16	+1
Tamil Nadu	120	45.1	111	43.8	-7	+3
Uttar Pradesh	174	85.7	188	84.5	+8	-1
All-India (except Bihar and West Bengal)	132	54.6[b]	135	51.0[c]	+2	-7

[a] 1972 only.
[b] 1971 and 1972 only.
[c] 1976 only.

Source: Data supplied to panel by Registrar General of India.

mortality between 1970-72 and 1975-76 may be spurious. In this regard it is noteworthy that Uttar Pradesh, Gujarat, and Rajasthan, which recorded substantial increases in infant mortality, experienced either decreases or much smaller increases in mortality below age 5. These are three of the four states (with Madhya Pradesh) that had the highest omission rates of infants in the 1971 census as judged from a match of census records with births recorded in the SRS (India, Registrar General, 1977c). The fact that the rise in infant mortality between 1970-72 and 1975-76 tended to be largest in states in which enumeration of infants is least satisfactory suggests that infant mortality rates in these states in 1970-72 may have been somewhat underestimated by the SRS. It does not seem likely that the infant mortality rate for all-India actually rose between those years, particularly since recorded $_5M_0$ declined by 7 percent despite some clear improvements in data quality (e.g., in Haryana and Jammu and Kashmir). As noted in Section 2.2, however, it is also possible that the incongruent decline in $_5M_0$ was a result of improving age statement in the early years of the SRS.

Before presenting equivalent information from other sources, it is useful to note that, from virtually any data set, India has high mortality below age 5 relative to mortality above age 5. The two model life table systems having this feature in the Coale-Demeny set of model life tables are the "East" and the "South" (Coale and Demeny, 1966). Of these two, the South was found to be far more representative of the SRS relations between $_1q_0$ and $_5M_0$ for the large majority of Indian states. The south model is therefore used throughout most of this section.

2.1.2 Estimates from CEB/CS Data

Table 8 presents a variety of child mortality estimates for all-India that are based on the information on children ever born (CEB) and children surviving (CS) to ever-married women collected in the NSS for 1965-1966, in the 1972 Fertility Survey, and in the 1979 Survey of Infant and Child Mortality. Methods adopted in converting the information available in each survey to life table parameters vary slightly and merit some attention. The CEB/CS data from the 1965-66 NSS are tabulated by effective duration of marriage; the duration intervals used

TABLE 8 Estimates of Infant and Child Mortality from Data on Children Born and Surviving of the 1965-66 NSS, the 1972 Fertility Survey, and the 1979 Surveys of Infant and Child Mortality: All-India

	1965-66 NSS (all religions)		1972 Fertility Survey		1979 Survey of Infant and Child Mortality		Time Reference of q(x) Values (years before survey)	
Age (x)	q(x)	South Level	q(x)	South Level	q(x)	South Level	1972 Fertility Survey	1979 Survey of Infant and Child Mortality
1	n.a.	n.a.	.130	13.8	.152	11.6	1.1	1.0
2	.225	10.6	.155	14.9	.143	15.7	2.4	2.1
3	.251	10.7	.175	14.7	.137	17.0	4.2	3.9
5	.277	10.2	.185	14.9	.145	17.1	6.4	6.1
10	.317	10.0	.203	14.7	.160	16.8	8.9	8.5
Graduated q(2)	.225		.154		.125		4.3[a]	4.0[a]

Note: n.a. = not available.

[a]Average of the estimates for q(2), q(3), and q(5).

Sources: India, National Sample Survey Organisation (1975); Dyson (1979b); India, Registrar General (1980b).

are 0-5, 6-9, 10-15, 16-25, 26-35, and 36 and above.[1] Since these intervals are unconventional, a new set of multipliers developed by Hania Zlotnik was used in the conversion of CEB/CS data into q(x) values (see Appendix A). In the 1972 and 1979 surveys, CEB/CS data are tabulated by age of mother. The values of q(x) were derived from the 1972 Fertility Survey using Trussell's "South" model coefficients (Trussell, 1975). South coefficients were also applied to all-India results from the 1979 survey.

The estimates presented in Table 8 for all-India from the 1972 Fertility Survey are not computed directly from the figures given in the Registrar General's publication but are derived as weighted averages of state-specific values of dead and surviving children.[2] Computations based directly on the source data (not shown) consistently give results well below the state average (except for q(1)), and it was not possible to identify the source of the discrepancy. The "graduated" values of q(2) are derived by identifying the level of mortality within the South model life table system corresponding to q(2), q(3), and q(5) and taking the value of q(2) in the model life table located at the average of those levels.[3] The time periods to which the various estimates of q(x) relate have been computed using the Coale-Trussell procedure (Coale and Trussell, 1978). These time periods could not be computed for the 1965-66 NSS because of its irregular tabulations; however, they should not be significantly different from the ones estimated for the later surveys.

A striking feature of the estimates presented in Table 8 is that, while comparison of q(x) values within surveys fails to reveal any real decline in child mortality (as indicated by the approximate constancy of estimated "levels"), comparison across surveys reveals substantial decline in child mortality, especially between the 1965-66 NSS and the 1972 Fertility Survey. This contradiction was not a product of the choice of model life table systems but persists regardless of which system is used. The main possible explanations are that a real decline in mortality was masked by the increasing omission of dead children by older women when q(x) values of the same survey are compared; or that a spurious decline is implied when estimates from the NSS and other surveys are compared because of either underestimation of mortality in the other surveys or overestimation of mortality in the NSS.[4] By showing little trend, the major additional

source of data--SRS child death rates--gives some support to the latter possibility, although it is not very informative for the earlier period.

According to our estimates, under a regime of declining mortality the graduated value of q(2) refers to a period approximately 4 years before the survey. Thus, the graduated value of q(2) from the 1965-66 NSS relates to about 1961, that of the 1972 Fertility Survey to about 1968, and that of the 1979 Survey of Infant and Child Mortality to about 1975. If the estimates from the three surveys are comparable, then the implication is that the probability of dying before one's second birthday declined from 0.225 in 1961 to 0.154 in 1968 and further to 0.125 in 1975. Such a huge decline in child mortality between 1961 and 1968 would have had to occur in a period of modest economic gains, a period that also saw at its end a resurgence of malaria in many parts of India.[5]

Two differences in the manner in which the surveys were conducted could have exaggerated the appearance of mortality decline between 1961 and 1968. One is a difference in questionnaire design. In the 1965-66 NSS, enumerators first asked each woman "number of children born alive but since dead" and then "number of children now alive" and "total number of children." The 1972 Fertility Survey reversed the order of the first two questions. Unlike the 1965-66 survey, it also asked separately about the number of children now living at home and the number now living elsewhere. It may therefore have elicited more living children, while the reordering of questions may have reduced the number of dead children reported. Both tendencies would have reduced estimated mortality. It should be noted that the 1979 inquiry asked only "total children born alive" and "total children surviving" without a direct question on the number of dead children or on the number of children living at home or away. The absence of these specific questions has probably biased downward the total volume of mortality as well as of fertility estimated from the 1979 survey. In addition, there have been suggestions that questions about fertility in surveys during the late 1970s have generated suspicion on the part of respondents about the interviewer's motives and have lead to downward bias.

The second difference is that the 1972 Fertility Survey results were tabulated by age and the 1965-66 NSS were tabulated by duration of marriage. Indirect estimation procedures should work about equally well in the two

cases. However, data by duration of marriage were reported not only for currently married women in their first marriage but also for remarried women and separated, divorced, or widowed women. Remarried women were treated properly from the point of view of mortality estimation: their duration of marriage was recorded from the date of first marriage to the survey date. However, the other women were assigned their marital duration at the time of disruption, so that the inferred amount of exposure of their children to the risk of mortality is biased downward. We have done a relatively extensive simulation of the possible magnitude of this bias in the all-India figures from the NSS because of its potential importance. We have assumed that the age structure of the ever-married female population is that of a "West" stable population with a growth rate of .02 and mortality level 8. Female marriage occurs at age 16. Husbands are assumed to be 5 years older at marriage and to have mortality level 11. With no remarriage, the proportion of people reported at duration 0-5 by the NSS tabulation would include 15 percent who are widowed and really belong to higher intervals; the figures are 16 percent at 6-9 and 17 percent at 10-15. These people would have married, on the average, 25, 28, and 32 years before the survey, which is an upper limit on the exposure of their children to mortality. Adopting a West model life table, they bias upward the proportion of children dead (and associated q(x) values) by 12 percent, 14 percent, and 11 percent, respectively. A majority of this bias, however, is eliminated by allowing remarriage, the frequency of which for women in India is adapted from Bhat and Kanbargi (1984). After adjustment for remarriage, the bias in proportion of children dead at 0-5, 6-9, and 10-15 years of marriage is, respectively, 4.2 percent, 5.9 percent, and 1.1 percent. This could explain only a small fraction of the 46 percent difference in graduated q(2)s between the 1965-66 NSS and the 1972 Fertility Survey; however, the bias could be larger (or smaller) in certain states.

A cross-check is also possible to ascertain the magnitude of the bias in child mortality estimates derived from the 1965-66 NSS. The data on children ever born and children surviving from the 16th round of the NSS (1960-61), available only for urban, currently married women, has been tabulated by age (India, Cabinet Secretariat, 1967). Estimates of q(x) values computed from this data could be readily compared with those derived from the 1965-66 NSS for urban India:[6]

Source	q(2)	q(3)	q(5)	q(10)	Graduated q(2)
NSS 16th round (1960-61)	.209	.213	.224	.294	.192
NSS 20th round (1965-66)	.176	.194	.231	.281	.178

The above comparison strongly supports the belief that the classification of widowed, divorced, and separated women according to their marital duration at the time of disruption has not significantly distorted the estimates of child mortality derived from the 1965-66 NSS. It also supports the relatively high values of child mortality found in the 1965-66 NSS for all-India.

The suspicion that the 1979 survey understated the actual levels of child mortality in the mid-1970s becomes stronger when the individual q(x) estimates from the 1972 and 1979 surveys are compared across cohorts. As the two surveys were exactly separated by 6.5 years in time, the estimate of q(1) from the 1972 survey and the estimate of q(2) from the 1979 survey, the estimate of q(2) from the 1972 survey and the estimate of q(3) from the 1979 survey, and so on, are approximately based on the experiences of children in the same cohorts of women. The examination of Table 8 (above) in this light reveals that, except for age 2, the estimates from the 1979 survey are lower than the corresponding lagged values from the 1972 survey. While a part of the discrepancy can be attributed to the fact that the interval between the surveys was greater than 5 years, a more probable reason seems to be that as women became older, they increasingly failed to report accurately the number of dead children. Thus the estimates of q(x) beyond age 2 from the 1979 survey and the graduated q(2) based on them are probably too low.

Even if we are to consider the ungraduated q(2) estimate of 0.143 from the 1979 survey as relatively free from the underreporting errors that plauge the estimates for older ages, it implies much lower level of child mortality than the estimates directly available from the SRS. The q(2) estimate of 0.143 referring approximately

to the period 1976-77, when transformed via the South model life table system, implies a death rate of 39.2 for the interval 0-4 and an infant mortality rate of 112. The corresponding estimates from the SRS for the period are 51.0 and 129, respectively. Thus, if we are to accept the q(2) value of 0.143 from the 1979 survey as reasonably accurate, we have to confront the possibility that the SRS was overestimating mortality in the mid-1970s, perhaps as much as by 15-30 percent under age 5. Indeed, that such a tendency in the SRS is not outside the realm of possibilities is also suggested by the intercensal survival analysis carried out for the decade 1971-81 in Chapter 3.

While a similar cohort comparison can be made for the estimates of the 1965-66 and the 1972 surveys, the interpretation is not as clear-cut as it was in the earlier case since the 1965-66 survey classified the data by duration intervals while the latter surveys used age categories for the classification. Instead, to cast further light on the validity of the levels and the implied trend, we examine the state-specific estimates of child mortality derived from the 1965-66 and 1972 surveys. The estimates of q(x) values computed from the CEB/CB data of the 1965-66 NSS and the 1972 SRS Fertility Survey for 15 major states of India appear in Tables 9 and 10. In the case of the 1965-66 NSS the requisite tabulations at the state level were available for Hindu households only (whereas the national figure was presented for all religions combined). The estimates of child mortality derived from this survey are therefore strictly applicable only to the Hindu population of the respective states. In 11 of the 13 major states (the exceptions are Punjab and Kerala), more than 70 percent of the population is Hindu.[7] As we demonstrate below, the estimates of child mortality derived from the 1965-66 NSS for Punjab and Kerala, where the Hindu proportion is low, seem to be largely consistent with the estimates derived from other sources. Inconsistencies are seen mainly in the estimates for certain other states, where the proportion of Hindu population is high.

Without losing much information, we may focus our attention only on graduated q(2) values computed from the estimates of q(2), q(3), and q(5). In passing, however, we may note that the comparison of q(x) estimates presented in Tables 9 and 10 reveals that q(x) estimates derived from the 1965-66 NSS are internally more consistent than those from the 1972 Fertility Survey, giving one reason for placing more confidence in the estimates derived from the 1965-66 NSS.

TABLE 9 Child Mortality Estimates by State from the 1965-66 NSS, Using the Regression Coefficients in Appendix A, Hindu Households Only: Selected States and All-India

State	Percent Hindus (1961 census)	q(2)	q(3)	q(5)	q(10)	Graduated q(2)
Andhra Pradesh	88.4	.239	.244	.276	.307	.227
Assam	71.3	.168	.168	.188	.194	.161
Bihar	84.7	.250	.275	.280	.314	.241
Gujarat	89.0	.159	.197	.240	.269	.175
Haryana	88.9	.200	.207	.257	.300	.197
Karnataka	87.3	.205	.232	.254	.291	.206
Kerala	60.8	.131	.159	.170	.210	.135
Madhya Pradesh	94.0	.264	.277	.314	.361	.256
Maharashtra	82.2	.223	.239	.264	.308	.219
Orissa	97.6	.274	.238	.278	.318	.236
Punjab	42.3	.179	.211	.187	.234	.168
Rajastham	90.0	.250	.260	.299	.361	.242
Tamil Nadu	89.9	.219	.250	.270	.290	.220
Uttar Pradesh	84.7	.351	.378	.392	.430	.341
west Bengal	78.8	.176	.178	.201	.258	.164
All-India (Hindus)	83.5	.232	.258	.283	.323	.231

Note: Separate estimates for rural and urban areas were combined employing the Hindu population (1961 census) in the respective areas as weights.

Source: Computed from India, National Sample Survey Organisation (1975).

The graduated q(2) values derived from the 1965-66 NSS and the 1972 Fertility Survey given in Table 11 are very consistent in their rank ordering of states, with northern states generally showing higher levels of child mortality than southern states. The figures also imply a large decline in child mortality in the states of Haryana, Bihar, Maharashtra, and Karnataka (more than 40 percent). A reduction by one-third or more is also implied in the states of Kerala, Tamil Nadu, Uttar Pradesh, and West Bengal. Whether these huge reductions in child mortality are real or spurious is difficult to ascertain. The little internal evidence available from the SRS does not support a large decline in child mortality, at least in the late 1960s. With the possible exception of Kerala, no sign of a significant reduction in infant mortality is observed in rural areas of the four states in which the SRS has been in full-scale operation since 1965-66:

State	Infant Mortality Rate (Rural) 1965-66	1970-72
Gujarat	147	151
Kerala	74	61
Karnataka	106*	103
Maharashtra	101	109

*Relates to 1966-77
Sources: Agarwala (1969); India, Registrar General (1975b, 1977d).

This impression is essentially maintained even for the states in which the operation was only on a pilot scale in the mid-1960s. The evidence, however, is subject to the qualification that the SRS had just begun in the late 1960s, and whatever decline had occurred may therefore have been masked by the improvements in enumeration. Another difficulty with the evidence is that, while infant mortality has remained constant, mortality at ages 1-2 could have declined, as happened in England and Wales in the late nineteenth century (McKeown and Record, 1962).

In the states in which a very large decline in child mortality has occurred, the estimates of q(x) values from the 1972 Fertility Survey should imply progressively lower levels of mortality as x increases. To examine whether this is actually the case we have computed graduated q(2) values from q(2) and q(3) estimates as well as from q(5) and q(10) estimates, under the assumption of a South model mortality pattern (see Table 12). The computation of graduated q(2) values has the advantage of reducing the effects of sampling errors in the q(x) estimates. Except for Kerala, none of the states in Table 12 shows any sign of a large reduction in child mortality in the years preceding the survey. In fact, for most states, the possibility of an increase in child mortality is indicated, perhaps due to more underreporting of dead children among older women or to an incorrect choice of the South model pattern.[8] However, unless progressive increase of underenumeration of dead children with age of mother was greater in the states in which the reduction of child mortality was greater, we should still expect a high degree of correlation between the ratios of graduated q(2) values of Table 11 and Table 12. The fact that

TABLE 10 Child Mortality Estimates by State from the 1972 SRS Fertility Survey, Using Trussell's Regression Coefficients on the Assumption of a South Mortality Pattern: Selected States and All-India

State	q(1)	q(2)	q(3)	q(5)	q(10)	Graduated Values of q(2)
Andhra Pradesh	.167	.168	.168	.188	.194	.155
Assam	.156	.172	.166	.186	.191	.155
Bihar	.038	.125	.149	.161	.165	.128
Gujarat	.139	.169	.182	.201	.222	.163
Haryana	.121	.111	.105	.131	.144	.101
Karnataka	.094	.123	.135	.146	.148	.119
Kerala	.062	.074	.218[a]	.121	.158	.084[b]
Madhya Pradesh	.157	.189	.192	.203	.222	.173
Maharashtra	.113	.137	.146	.145	.183	.126
Orissa	.184	.229	.201	.203	.226	.188
Punjab	.238	.145	.136	.148	.191	.126
Rajasthan	.123	.164	.186	.319[a]	.214	.164[c]
Tamil Nadu	.136	.162	.150	.149	.177	.136
Uttar Pradesh	.162	.226	.262	.283	.311	.230
West Bengal	.095	.113	.127	.047	.154	.112[c]
All-India	.130	.155	.175	.185	.203	.154

[a]Believed to be biased by a misprint in the baseline data. To be specific, the proportion of children surviving to rural Keralan women aged 25-29 indicated by the figures in India, Registrar General (1976b:74) is out of line both with the figures of other age-groups and the indications of urban women of the same age. In the case of Rajasthan, on page 75 of the same report, the printed number of children born alive to rural women aged 30-34 is unrealistically high by about one child and is out of line with the indications of other age groups; this apparent error produces the high q_5 value for Rajasthan.

[b]Based on q_2 and q_5.

[c]Based on q_2 and q_3.

Source: Dyson (1979b).

this correlation is only +.21 casts some doubt on the validity of a huge decline in child mortality in the 1960s.

Table 11 also shows a comparison of the graduated q(2) values from the two surveys to the q(2) values implied by the SRS infant mortality rate and the death rate below age 5, $_5M_0$. In transforming the SRS rates into q(2) estimates, the South model mortality pattern was assumed to be applicable and a suitable correction was applied for the fact that $_5M_0$ values from the SRS are weighted by the age distribution under age 5.[9] The estimates presented in Table 11 show a high degree of correspondence

TABLE 11 Comparisons by State of the Estimates of q(2) Derived from the 1965-66 NSS, the 1972 Fertility Survey, and the Infant Mortality Rates and $_5M_0$ of the SRS: Selected States and All-India

State	1965-66 NSS (Hindu households)	1972 Fertility Survey	SRS 1970-72		SRS 1974-76	
			IMR	$_5M_0$	IMR	$_5M_0$
Andhra Pradesh	.227	.155	.144	.156	.158	.167
Assam	.161	.155	.178	.170	.178	.160
Bihar	.241	.128	.129[a]	.130[a]	n.a.	n.a.
Gujarat	.175	.163	.191	.205	.204	.187
Haryana	.197	.101	.096	.119	.142	.158
Karnataka	.206	.119	.117	.133	.102	.108
Kerala	.135	.084	.065	.096	.061	.078
Madhya Pradesh	.256	.173	.196	.129	.196	.131
Maharashtra	.219	.126	.126	.145	.105	.122
Orissa	.236	.188	.172	.188	.185	.179
Punjab	.168	.126	.136	.143	.129	.131
Rajasthan	.242	.164	.169	.196	.201	.197
Tamil Nadu	.220	.136	.156	.157	.142	.153
Uttar Pradesh	.341	.230	.243	.255	.264	.252
West Bengal	.164	.112	.131[a]	.119[a]	n.a.	n.a.
All-India (all religions)	.225	.154	.175	.182	.180	.176
All-India (except Bihar and West Bengal)	.231	.162	.175	.182	.180	.176

Note: n.a. = not available

[a]For 1970 only.

TABLE 12 Examination of Time Trend in Child Mortality Levels by Intra- and Inter-Survey Comparisons: Selected States and All-India

State	1972 SRS Fertility Survey Graduated q(2) Values from		Ratio	Ratio of Graduated q(2) of 1972 Survey to 1965-66 Survey Estimate[a]
	q(2) and q(3)	q(5) and q(10)		
	(1)	(2)	(1) ÷ (2)	
Andhra Pradesh	.157	.147	1.08	.68
Assam	.158	.143	1.10	.96
Bihar	.128	.123	1.04	.53
Gujarat	.165	.162	1.02	.93
Haryana	.101	.103	.98	.51
Karnataka	.120	.110	1.09	.58
Kerala	.074[b]	.104	.71	.62
Madhya Pradesh	.179	.163	1.10	.68
Maharashtra	.132	.123	1.07	.57
Orissa	.202	.164	1.23	.80
Punjab	.131	.127	1.03	.75
Rajasthan	.164	.157[c]	1.04	.68
Tamil Nadu	.146	.123	1.19	.62
Uttar Pradesh	.230	.233	.99	.67
West Bengal	.112	.111[c]	1.01	.67
All-India	.154	.148	1.04	.68

[a]Graduated q(2) values derived from q(2), q(3), and q(5).
[b]Based on q(2) only.
[c]Based on q(10) only.

in both level and geographic pattern between the graduated q(2) values derived from the 1972 Fertility Survey and those computed directly from the SRS rates. The coefficient of correlation between the state-specific estimates from the 1972 Fertility Survey and the averages of the two estimates from the 1970-72 SRS is 0.95. But this high degree of consistency may in part be the consequence of the use of the same infra- structure in the collection of data.

In the beginning of this chapter, we alerted the reader to the possibility that SRS infant mortality rates for Gujarat, Rajasthan, and Uttar Pradesh for the period 1970-72 may be somewhat lower than the levels actually prevailing. Table 11 shows that in these states the 1972 Fertility Survey gives even lower estimates of q(2) than those derived from the SRS infant mortality rates of 1970-72. The use of another model pattern such as West or East could have reversed this ordering, but it is

important to note that q(2) estimates derived from $_5M_0$, which are reduced by the choice of the South pattern, are even higher. Other states in which the 1972 Fertility Survey produces a lower estimate of child mortality than does the 1970-72 SRS are Assam, Haryana, Punjab, Tamil Nadu, and West Bengal.

Several other tests were made to evaluate the 1966 and 1972 surveys. Table 13 presents state-specific rural-urban estimates of q(2) values (graduated) from the 1972 Fertility Survey and the 1965-66 NSS. This table also shows urban-rural differences in female literacy by state and an index of the urban bias in health services. Estimates from the 1972 Fertility Survey for the states of Haryana, West Bengal, and Kerala imply negligible rural-urban differentials in child mortality. The relatively small difference in urban and rural child mortality levels in Kerala can be justified on the grounds that its rural and urban females are almost equally literate and that the state has the most equitable distribution of health services between rural and urban areas. Also lending support is the small urban-rural difference in child mortality from the 1965-66 NSS. In the states of Haryana and West Bengal, however, little independent evidence is forthcoming for accepting the 1972 Fertility Survey estimates. In West Bengal medical services are relatively better distributed between rural and urban areas, but there is a large gap between rural and urban literacy levels. It seems more credible that the 1972 Fertility Survey has underestimated child mortality in the rural areas of these two states.

Child mortality estimates for the state of Bihar from the 1972 Fertility Survey are also of questionable validity. While the implied rural-urban differential is large, it is doubtful that child mortality in rural areas of Bihar is even lower than the level prevailing in the urban areas of neighboring Uttar Pradesh; nor is it likely that among the urban areas of India urban Bihar has one of the lowest child mortality levels. By advancing similar arguments, it is also possible to throw suspicion on the estimates of child mortality derived from the 1965-66 NSS for the rural areas of Bihar, Gujarat, and Orissa. In this context it is significant that child mortality estimates from the 1965-66 NSS for the state of Gujarat fall below even the range indicated by the 1970-72 SRS (see Table 9). In Karnataka and Maharashtra, where the implied decline in child mortality was largest, we have not uncovered any evidence to suspect the 1972 Fertility Survey estimates.

TABLE 13 Urban-Rural Differences by State in q(2) Estimates (graduated) Derived from CEB/CS Data: Selected States and All-India

State	1972 Fertility Survey		1965-66 NSS (Hindu households)		Urban-Rural Difference in Percent of Female Literacy (age 5 and over), 1971	Ratio of Proportion of Hospital Beds in Rural Areas to Proportion of Rural Population, 1966-67
	Rural	Urban	Rural	Urban		
Andhra Pradesh	.166	.108	.232	.197	29.3	.11
Assam	.159	.099	.165	.119	39.1	.16
Bihar	.139	.072	.246	.229	29.8	.28
Gujarat	.170	.134[a]	.177	.167	31.6	.39
Haryana	.103	.091	.207	.149	37.0	.25
Karnataka	.127	.094	.218	.155	31.2	.20
Kerala	.089[b]	.071	.135	.132	8.1	.44
Madhya Pradesh	.188	.109	.262	.217	36.5	.19
Maharashtra	.130	.117	.235	.150	34.0	.05
Orissa	.193	.140	.236	.234	28.4	.40
Punjab	.139	.091	.185	.151	29.0	.20
Rajasthan	.172[c]	.111	.250	.196	30.1	.20
Tamil Nadu	.154	.094	.228	.196	30.3	.48[d]
Uttar Pradesh	.238	.158	.352	.249	30.8	.14
West Bengal	.108[c]	.105	.175	.136	36.4	.46
All-India (all religions)	.163[e]	.112[e]	.241	.182	33.3	.25[e]

[a]Based on q(3) and q(5).
[b]Based on q(2) and q(5).
[c]Based on q(2) and q(5).
[d]Relates to 1964.
[e]Pooled estimate for above 15 s...

Source: Computed from India, Registrar General (1975a, 1976b, 1977a); India, National Sample Survey Organisation (1975); and India, Director General of Health Services (1972, 1976); United Nations (1983).

As a second test of the CEB/CS data, state-specific estimates of child mortality were compared with respective socioeconomic levels and with independently computed adult mortality levels. More specifically, two ordinary least-squares regressions were computed, one with q(2) regressed on female literacy (15 years and over) and per capita income as explanatory variables, and the other with preliminary intercensal estimates of life expectancy at age 5 (e_5) as the regressor. The residuals from these two regressions were examined for identifying outliers. For convenience a decadal estimate of child mortality was used as the dependent variable, which was computed by giving a weight of 5/7 to the graduated q(2) estimate from the 1972 Fertility Survey and a weight of 2/7 to the estimate from the 1965-66 NSS.[10] The estimated equations along with the standard errors of the coefficients are given below.

$$(1)\quad 1000q(2) = 260.86 - \underset{(0.7194)}{2.0145}\ FLIT - \underset{(0.1220)}{0.1934}\ INC \qquad (R^2=0.54)$$

$$(2)\quad 1000q(2) = 675.73 - \underset{(3.2325)}{9.2352}\ e_5 \qquad (R^2=0.39)$$

The unstandardized residuals from the above regressions are shown in columns 5 and 6 of Table 14. There is a high degree of correspondence among the residuals from the two regressions--the correlation coefficient between the two series is 0.70. Both comparisons indicate that the child mortality estimates are relatively low in the states of Bihar, Haryana, Karnataka, and West Bengal, and they are relatively high in Uttar Pradesh and Gujarat. The evidence from the two residual analyses is slightly contradictory in the case of Maharashtra, Rajasthan, Madhya Pradesh, and Tamil Nadu.

It is noteworthy that a strong geographical pattern is observed in the residuals of the child/adult mortality regression. All southern states, including Maharashtra, have relatively low child mortality estimates compared with their adult mortality levels; all central and northwestern states with the sole exception of Haryana have relatively high child mortality estimates compared with their adult mortality levels. This tendency, while boosting our confidence in the decadal estimates of mortality, reduces to some extent the significance of the individual residuals from the adult mortality regression in detecting errors in child mortality estimates.

TABLE 14 Regression Analyses of State-Specific Estimates of Child Mortality for Identifying Outliers: Selected States of India

State	Graduated q(2) Values	Female Literacy (15 years and above)	Per Capita Income in Rupees at 1960-61 Prices	Life Expectancy at Age 5 (e_5)	Residuals from Regression $(q(2)-\hat{q}(2))$	
	About 1966	1961-71	1961-71	1961-71	Model 1	Model 2
	(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	.176	14.0	290	52.9	-.001	-.011
Assam	.157	19.0	341	55.2	.000	-.009
Bihar	.160	7.8	211	54.3	-.044	-.014
Gujarat	.166	23.3	391	56.3	+.028	+.010
Haryana	.128	12.6	364	58.3	-.037	-.009
Karnataka	.144	17.5	322	53.7	-.019	-.036
Kerala	.099	15.7	273	60.7	-.005	-.016
Madhya Pradesh	.197	8.8	247	54.0	+.002	+.020
Maharashtra	.153	21.7	408	55.8	+.015	-.007
Orissa	.202	10.9	250	51.6	+.011	+.003
Punjab	.138	20.1	407	60.3	-.004	+.019
Rajasthan	.186	7.3	284	56.3	-.005	+.030
Tamil Nadu	.160	21.2	330	53.9	+.006	-.018
Uttar Pradesh	.262	8.9	250	53.7	+.067	+.082
West Bengal	.127	22.1	389	54.7	-.014	-.044

Notes and Sources:

Column 1: Weights of 2/7 for the estimates from the 1965-66 NSS and 5/7 for those from the 1972 Fertility Survey were employed.

Column 2: Computed from India, Registrar General (1965, 1977a); mean of 1961 and 1971 values.

Column 3: India, Reserve Bank (1978) and India, Kerala, Bureau of Economics and Statistics (1977). Since the base years for Assam and Karnataka were other than 1960-61, an ad hoc adjustment was made by multiplying the net domestic product at constant prices by the GNP deflator for 1960-61.

Column 4: Dyson (1979b). Estimates are based on the South model mortality pattern; male and female e_5 values were combined using the respective populations as weights.

Finally, we present in Tables 15 and 16 estimates of child mortality from independent sources in the states for which they are available. Table 15 shows the results of Census Fertility Inquiries converted into mortality estimates. These are valuable for showing in every state for which estimates are available that child mortality is estimated to be higher than in the 1965-66 NSS. If the NSS estimates were higher than those in the earlier Census Fertility Inquiries, there would be grounds for serious doubt about the NSS validity, but this proves not to be the case.

2.1.3 Child Mortality Estimates State by State

We now proceed to a state-by-state discussion and synthesis of the data and checks with the aim of arriving at final estimates. We focus on the 1972 Fertility Survey results because they are more suspect, because they are more critical to intercensal analysis since they are "dated" closer to midcensus, and because there are more independent sources for evaluating them.

2.1.3.1 Andhra Pradesh

The 1972 Fertility Survey child mortality estimate for Andhra Pradesh is considered to be low for two reasons: slightly higher q(2)s based on the SRS rates for 1974-76 and the fact that, compared with the estimated adult mortality level, the child mortality estimates appear to be low. Andhra Pradesh being a southern state, however, the latter may simply reflect actual variation in the adult/child mortality relationship. A small increase in SRS infant and child mortality indices by itself is not a compelling reason to assume that the estimate from the 1972 Fertility Survey is low, since the increases could be real. We therefore accept the estimate from this survey without any correction. We have little evidence to doubt the estimate from the 1965-66 NSS and therefore accept it without correction.

2.1.3.2 Assam

The 1972 Fertility Survey estimate for Assam is lower than the corresponding estimate from the 1970-72 SRS, but

the SRS figures are also higher than the graduated q(2) value from the 1965-66 NSS. None of the other consistency checks suggests that the possibility of underestimation of child mortality in the two surveys is likely. And as we show below, Assam is the only state for which tests of death registration completeness in the SRS clearly suggest overregistration. Therefore, we accept the child mortality estimates from the two surveys without any adjustment.

2.1.3.3 Bihar

For Bihar the regression analyses strongly suggest the possibility of underestimation of mortality in the 1972 Fertility Survey. The difference between the rural and urban estimates of this survey is quite large, but, as pointed out earlier, there is a strong possibility that the survey has underestimated child mortality in both rural and urban areas. A close agreement is found, however, between the estimates of child mortality derived from the 1972 Fertility Survey and those computed directly from the SRS. On the other hand, there is compelling evidence (and agreement by the Registrar General's office) that the SRS figures for this state for the early 1970s reflect serious underregistration of deaths. Overall we consider the evidence as sufficiently overwhelming to justify discarding the child mortality estimate from the 1972 Fertility Survey. A new estimate is computed by assuming that the pace of the child mortality decline in Bihar was the same as that of all-India and by accepting the estimate from the 1965-66 NSS without any correction. It is possible, however, that the figure from the 1965-66 NSS for the state is also an underestimate.

2.1.3.4 Gujarat

The indications from consistency checks are contradictory in the case of Gujarat. The graduated q(2) value computed from the 1972 Fertility Survey and the 1965-66 NSS is lower than the q(2) value estimated from the SRS infant mortality rate of 1970-72; and the infant mortality rate has shown a tendency to increase, suggesting that its 1970-72 level was itself an underestimate. The possibility of underestimation of child mortality in the 1965-66 NSS is reinforced by the negligible rural-urban differential observed in the child mortality estimates of this

TABLE 15 Child Mortality Estimates Derived from Census Fertility Inquiries Using South Model Variant Regression Coefficients: Selected States and Areas of India

	Geographical Coverage	Estimates of						
		$P_{(1)}/P_{(2)}$ [a]	$P_{(2)}/P_{(3)}$ [a]	q(2)	q(3)	q(5)	q(10)	Graduated q(2)
Assam								
1941 Census	Gauhati subdivision except Gauhati Thana (Hindus only)	.1997	.5531	.298	.325	.362	.398	.297
Delhi								
1941 Census	Former Delhi province	.2049	.5809	.313	.298	.338	.372	.286
Jammu and Kashmir								
1941 Census	Jammu and Ladakh districts	.2137	.5421	.285	.244	.345	.309	.261
Karnataka								
1941 Census	Former Princely State of Mysore	.2439	.5577	.249	.262	.288	.340	.239
Kerala								
1941 Census	Travancore State (Caste groups with population less than 50,000 excluded)	.1383	.4750	.168	.165	.173	.216	.150
1951 Census	Travancore-Cochin (10-percent sample)	.1092	.4559	.204	.220	.235	.258	.196

Madhya Pradesh								
1921 Census[b]	Former central provinces and Berar	.4518	.6275	n.a.	.279	.326	.338	.259
1951 Census	Former state of Madhya Pradesh	.2196	.5776	.356	.362	.397	.423	.339
Punjab								
1921 Census[b]	Former province of Punjab	.3461	.6408	.247	.226	.231	.260	.193
Rajasthan[c]								
1941 Census	Ajmer-Merwara and about 13 princely states of Rajaputana (3 major caste groups)	.3342	.6399	.335	.334	.352	.388	.309
West Bengal								
Census Pilot Study, 1951	Rural areas of seven districts	.2839	.5767	.242	.264	.269	.304	.232

Note: n.a. = data not available for making the requisite computations.

[a]Assumptions made in computing average parities for all women in each age/duration category were too elaborate to be discussed here. The procedures varied depending on the data availability.

[b]Data tabulated by duration of marriage (effective); others tabulated by age.

[c]CEB/CS data not classified by age intervals of 17-21, 22-26, etc.

Source: Provincial/state volumes of the census of India for the dates indicated.

TABLE 16 Estimates of Child Mortality Derived from CEB/CS Data of Selected Demographic Sample Surveys: Selected Areas of India

	Area Covered[a]	Date of Survey	Sample Women	q(2)	q(3)	q(5)	q(10)	Graduation q(2)
Karnataka								
Mysore Population Study	Bangalore division and parts of Hassan and Mysore districts	1951-52	14,284[b]	.253	n.a.	.293	n.a.	.246
Bangalore Population Study	Bangalore division	1975	4,722[b]	.136	n.a.	.195	n.a.	.145
Tamil Nadu								
Tamil Nadu Family Planning and Fertility Survey	Entire state	1971-72	5,435[c]	.156	.191	.211	.243	.164
Uttar Pradesh								
Banaras Survey	Rural areas of Banaras tehsil	1956	1,633[d]	.301	.296	.370	.384	.291
Rural U.P. Survey	Rural areas of the state	1956	1,336[c]	.351	.305	n.a.	n.a.	.311
Gorakhpur Region Survey	Rural areas of Gorakhpur division	1969-71	1,296[c]	.248	.288	.335	.337	.260

Note: In converting average parities of married women into average parities of all women, it was assumed that widowed, divorced, and separated women had same parity as married women; child bearing is restricted to married and widowed women only; and marital status distribution can be approximated by the census figures.

[a]A division refers to a group of districts, while a tehsil is an administrative subunit within the district.
[b]Ever-married women.
[c]Currently married women.
[d]Women in unbroken marriage unions.

Sources: Computed from United Nations (1961); Srinivasan et al. (1977); Mukherjee (1975); Rele (1963); Saxena (1962); Saksena and Rastogi (1975).

survey. Contrary to the above, however, the regression analyses show that the decadal estimate of child mortality in this state is relatively high compared with its socio-economic level and its adult mortality level. In the presence of these conflicting reports, we decided to leave the estimates untouched. Additional data are needed to make a more definitive estimate.

2.1.3.5 Haryana

There is strong evidence indicating that the child mortality estimate from the 1972 Fertility Survey for Haryana is an underestimate. Although the estimate from this survey conforms with the SRS rates of 1970-72, figures for later years from the SRS indicate the possibility that the early figures were underestimates. Unusually small rural-urban differentials in the 1972 survey estimates are in keeping with that possibility. In addition, the q(2) value predicted from the state literacy and income levels turns out to be significantly higher than the decadal estimate derived from the CEB/CS data. The residual error from the adult mortality regression for this state is negative, but all other northern states have a positive deviation. Thus the case for the underestimation of child mortality in the 1972 Fertility Survey is persuasive, but the best we could do in the absence of independent data is to replace the estimate from this survey with the average of the q(2) estimates derived from the infant mortality rate and the ${}_5M_0$ value from the 1974-76 SRS.

2.1.3.6 Karnataka

The child mortality estimate for Karnataka is relatively low compared with the female literacy and income levels. In addition, a large negative residual error from the adult mortality regression cannot be wholly attributed to regional variation in the adult-child relationship. But the 1972 Fertility Survey estimate for this state compares well with the rates from the 1970-72 SRS. Comparison of the 1970-72 and the 1974-76 figures does not imply any improvement in the completeness of the SRS. The computation of rural and urban figures from the 1972 Fertility Survey also shows normal patterns. Fortunately, however, some independent data exist for the state that support

the possibility of underestimation of child mortality in the 1972 Fertility Survey. The Bangalore Population Study conducted in 1975 provides an estimate of q(2) (graduated) of 0.145, which is considerably higher than the 1972 Fertility Survey estimate (see Table 15). Although the Bangalore Population Study did not cover the entire state of Karnataka, it is unlikely that the child mortality rate in the study area was higher than in other parts of the state. The child mortality estimate from the 1972 Fertility Survey was therefore replaced by an estimate computed in the following way: Average annual decline in child mortality was calculated from the estimates of q(2) derived from the Bangalore Population Study and the Mysore Population Study conducted in the same region (see Table 16). This rate was applied to the graduated q(2) value from the 1965-66 NSS to produce an estimate for 1968, the reference date of graduated q(2) values from the 1972 Fertility Survey.

2.1.3.7 Kerala

There is little reason to doubt the child mortality estimate derived from the CEB/CS data for Kerala. A small negative residual error from the e_5 regression may be the result of genuine variation in the adult/child mortality relationship. However, the estimate derived from the 1965-66 NSS could be slightly biased upward, since it relates to Hindus only. This is the only state for which within-survey variation in q(x) strongly suggests a mortality decline.

2.1.3.8 Madhya Pradesh

The estimates from the CEB/CS data for Madhya Pradesh do not seem to need a significant correction. The fairly high child mortality estimate relative to the estimated adult mortality level is explainable from the hypothesized regional variation in the adult/child mortality relationship. The 1951 census results are substantially higher than those for 1965-66.

2.1.3.9 Maharashtra

The comparison of the estimates from the 1965-66 NSS and the 1972 Fertility Survey for Maharashtra indicates one

of the largest reductions in child mortality, even though the q(x) values of the 1972 Fertility Survey did not show signs of a large reduction. We observe that none of the consistency checks suggests that the underestimation of child mortality in the 1972 Fertility Survey is likely. However, a relatively high decadal q(2) estimate compared with literacy and income levels points to the possibility of overestimation of child mortality in the 1965-66 NSS. While this inference is not inconsistent with the findings of other diagnostic tests, there is no independent source from which to make an alternate estimate of q(2). Therefore, with some hesitation, we accept the estimate from the 1965-66 NSS without adjustment.

2.1.3.10 Orissa

Evidence for Orissa is inconclusive. As in Maharashtra, a positive residual from the regression with two socio-economic variables suggests the possibility of an overestimation of mortality in the 1965-66 NSS. But as observed earlier, the relatively small rural-urban differential in the estimates of this survey points to the possible underestimation of mortality in rural areas. Since the suggested margin of error is relatively small, we decided to leave the estimates unaltered.

2.1.3.11 Punjab

For Punjab the estimate from the 1972 Fertility Survey falls short of those derived from the 1970-72 SRS. As none of the other consistency checks supports the possibility of an underestimation of child mortality in the 1972 Fertility Survey, we have accepted the estimate. However, the estimate from the 1965-66 NSS could be slightly inaccurate since it refers to Hindus only. Unlike the Kerala estimate, the direction of the bias in this case cannot be predicted. Although the non-Hindus may have lower child mortality, a higher fraction of Hindus are urban dwellers in this state.

2.1.3.12 Rajasthan

The child mortality estimate from the 1972 Fertility Survey for Rajasthan is slightly lower than those com-

puted from the 1970-72 SRS. It is also possible that the infant and child mortality indices of the 1970-72 SRS were themselves underestimated. But the decadal estimate of q(2) seems to be about right. Although its value is relatively high compared with the e_5 estimate, this could be explained by regional patterns in the adult/child mortality relationship. A possibility that is not altogether inconsistent with the findings of the diagnostic tests is that while the 1965-66 NSS has overestimated child mortality in this state, the 1972 Fertility Survey has underestimated it. Since there is little independent evidence to support this claim, no correction was deemed necessary for the estimates derived from the CEB/CS data.

2.1.3.13 Tamil Nadu

The child mortality estimate derived from the 1972 Fertility Survey for Tamil Nadu is considerably lower than that computed from the 1970-72 SRS. The residual from the e_5 regression is also negative, which, is at least partly explained by the possible regional variation in the adult/child mortality relationship. Fortunately, in Tamil Nadu we can also make an independent estimate of child mortality. The CEB/CS data from a statewide survey conducted in 1971-72 produces a graduated q(2) value of 0.165, compared with the value of 0.136 from the 1972 Fertility Survey (see Table 16). As the former is more comparable to the estimates derived from the 1970-72 SRS, we decided to accept it in place of the latter.

2.1.3.14 Uttar Pradesh

The estimates of child mortality for Uttar Pradesh are most intriguing. Very large positive residuals from regression analyses suggest the possibility that we have overestimated child mortality. Since the 1972 Fertility Survey estimate is lower than the corresponding estimates from the 1970-72 SRS, it seems unlikely that the 1972 survey has overestimated child mortality. However, there is weak confirmation for the possible overestimation of mortality in the 1965-66 NSS from the results of two surveys conducted in the mid-1950s in a few rural areas of Uttar Pradesh (see Table 15). According to these two surveys, the level of q(2) in rural Uttar Pradesh was in

the neighborhood of 0.300 in the early 1950s, while the corresponding estimate from the NSS is about 0.350 in the early 1960s.

Unfortunately, the sample size and the geographical area covered in the earlier surveys are not large enough to warrant the rejection of the estimate from the 1965-66 NSS. Also to be noted is that, even if a correction is applied to the estimate of child mortality from the 1965-66 NSS, the residuals from the regressions will not significantly diminish unless a much lower value is also assumed for the 1972 Fertility Survey. The evidence from the SRS and an independent source (see Table 15) is much too strong to consider the 1972 Fertility Survey estimate for this state high.

2.1.3.15 West Bengal

The evidence seems to be sufficient to reject the 1972 Fertility Survey estimate for West Bengal. The child mortality estimate from this survey is lower than those computed from the 1970 SRS. Moreover, the early figures from the SRS for this state were themselves underestimates (see Section 2.2). Large negative residuals from regression analyses and the small rural-urban difference in estimated child mortality also suggest underestimation in the 1972 Fertility Survey. The much higher 1965-66 NSS figure is still much lower than those of the 1951 Census Inquiry. In the absence of an independent data source, we accepted the q(2) estimate corresponding to the infant mortality rate of the 1970 SRS.

Since the SRS-based estimates for Bihar and West Bengal are suspect, Table 9 provides the most reliable basis for judging the effect of eliminating Bihar and West Bengal from the all-India estimates of child mortality. Bihar, with a population of 56.4 million in 1971, has a graduated q(2) of .241 (.010 above all-India); West Bengal, with a population of 44.3 million of India's 548.1 million, has a graduated q(2) of .164. Thus excluding the Bihar and West Bengal figures raises the graduated q(2) (Hindus only) for all-India from the .231 shown in Table 9 to .236--some 2 percent.

2.1.4 Summary

Our final estimates of child mortality appear in Table 17. In only 5 of 15 states did we find the evidence

TABLE 17 Final Estimates of q(2): Selected States and All-India

State	About 1961	About 1968	Mid-Decade
Andhra Pradesh	.227	.155	.176
Assam	.161	.155	.157
Bihar	.241	.169[a]	.190
Gujarat	.175	.163	.166
Haryana	.197	.150[a]	.163
Karnataka	.206	.134[a]	.155
Kerala	.135	.084	.099
Madhya Pradesh	.256	.173	.197
Maharashtra	.219	.126	.153
Orissa	.236	.188	.202
Punjab	.168	.126	.138
Rajasthan	.242	.164	.186
Tamil Nadu	.220	.164[a]	.180
Uttar Pradesh	.341	.230	.262
West Bengal	.167	.131[a]	.141
All-India	.225 (.234[b])	.164[c]	.184[c]

[a]Adjusted estimates; see text for explanation.
[b]Hindus only.
[c]State estimates weighted by states population.

sufficiently strong for rejecting the estimates derived from the CEB/CS data in 1972. The five states for which alternate values were assumed were among the 8 states for which comparison of the 1965-66 NSS and the 1972 Fertility Survey indicated a decline of child mortality of one-third or more. At the all-India level, assuming alternate values for 5 states did not substantially reduce the magnitude of the implicit decline in child mortality during the 1960s. While the unadjusted values implied a decline of 32 percent in child mortality, the new values imply a 27-percent reduction in 7 years, an annual rate of decline of 3.8 percent. The graduated q(2) of .125 for 1979 thus implies that a decline of 24 percent occurred over the subsequent seven-year period, so that the pace of decline appears relatively constant. However, the decline may be overestimated for the latter period

because we have been able to adjust (upward) the earlier estimate but not the later one.

For similar reasons the regional pattern of results may be somewhat less accurate after the adjustments than before. Because of the availability of independent survey information in several states (especially Karnataka and Tamil Nadu), we have been able to adjust their 1972 Fertility Survey estimates. Had similar information been available for other states, it may have produced similar adjustments. Nevertheless, a distinct regional patterning, particularly a north/south distinction, appears in both our adjusted and unadjusted results.

We referred earlier to the discrepancy between the strong implied decline in child mortality from the 1965-66 to the 1972 survey and the absence of apparent decline when one survey is examined in isolation. Since we have concluded that a very sizable decline did in fact occur, the most likely explanation of the discrepancy is that older women are omitting a higher fraction of dead children. That older women are omitting a higher fraction of children ever born is also suggested in Section 2.3, and it seems reasonable to expect that dead children are the most frequently omitted.

2.2 MORTALITY AT OTHER AGES AND ALL AGES

From its inception the Sample Registration System has generated data on deaths by age and on the population at risk of death. These are processed into crude death rates, which have appeared irregularly in Bulletins. Table 18 presents the SRS crude death rates by state through 1979, and Table 19 presents certain functions in life tables based on age-specific data for all-India, exclusive of Bihar and West Bengal.[11]

The major issue in interpreting the figures in Tables 18 and 19 is, of course, the accuracy and completeness of the SRS mortality data. The accuracy of the age data in the SRS is probably somewhat better than average for Indian data because the households involved have usually been visited for several years. Age heaping in the quinquennial age distribution of SRS households is not as severe as that in Indian censuses. It is also useful to note that age at death is determined by reference to the decedent's age at the time of the last visit to his or her household, rather than from a declaration by a living relative. Therefore, age-specific death rates should not

TABLE 18 Unadjusted Crude Death Rates from the Sample Registration System: Selected States and All-India

State	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1979[a]
Andhra Pradesh	15.8	14.6	16.1	16.6	15.2	15.2	14.5	14.2	13.3	12.8	12.6
Assam	16.2	17.8	17.9	16.4	16.8	16.9	14.9	12.9	13.2	11.4	11.2
Bihar	14.1	14.2	18.3	14.7	15.9	13.3	12.1	12.1	13.3	13.0	15.1
Gujarat	17.4	16.4	14.9	15.8	13.0	15.4	15.3	14.8	12.7	13.1	12.9
Haryana	9.4	9.9	11.7	12.1	12.6	12.3	12.8	13.7	13.5	10.6	10.5
Karnataka	13.1	12.1	12.8	12.4	10.8	11.1	11.7	11.1	12.0	10.4	10.4
Kerala	9.2	9.0	9.2	8.5	7.8	8.4	8.1	7.3	7.0	6.8	6.9
Madhya Pradesh	16.4	15.6	18.7	16.9	15.8	18.5	16.5	17.9	15.1	15.1	15.3
Maharashtra	11.9	12.3	12.8	13.6	11.5	11.4	11.3	12.8	10.3	10.9	10.7
Orissa	16.4	15.5	20.0	18.2	15.8	17.7	15.8	16.6	14.1	15.0	14.8
Punjab	11.2	10.3	12.6	12.1	10.6	10.8	11.0	10.8	11.6	9.9	9.5
Rajasthan	17.6	15.6	16.8	16.1	14.3	15.9	14.7	14.8	15.6	12.8	12.8
Tamil Nadu	15.6	14.4	15.1	14.1	13.9	15.0	14.6	13.7	12.8	12.1	12.1
Uttar Pradesh	21.6	20.1	25.6	19.4	19.7	22.6	20.5	19.1	20.2	16.2	16.2
West Bengal	10.6	--	--	--	12.4	13.0	11.9	11.7	11.6	--	21.1
All-India	15.7										13.0
All-India (except Bihar and West Bengal)	16.0[b]	15.2[b]	16.9	15.5	14.5	15.9	15.0	14.7	14.2	12.8	12.8

[a] "Pooled" estimates incorporating new SRS areas. Figures for Bihar and West Bengal refer only to new areas.
[b] State-weighted.

Sources: India, Registrar General, Sample Registration Bulletins: Vol. XV(1), June 1981; Vol. XIII(1), June 1979; Vol. XII(1), June 1978; Vol. XI(1), January 1977; Vol. IX(1), January 1975.

be affected by differential age misreporting between numerator and denominator. The most likely effect of age misreporting on age-specific mortality is a spurious inflation of death rates at ages 0-4 because the tendency to round age upward would deprive this age group of its lowest-mortality segment. This tendency would be strongest in the earlier stages of SRS operation, since age in SRS semiannual interviews is determined by adding 6 months to the age previously recorded. The situation is less straightforward with regard to the elderly. Age-specific data from the SRS show much more rapid increases with age in age-specific death rates beyond ages 40-44 than is contained in any of the Coale-Demeny model life tables at comparable mortality levels. The intercensal age check summarized in Table 4 (Chapter 1) raises the possibility that this pattern is spurious, caused by net age understatement, contrary to normal patterns expected at older ages.

Even more important for mortality estimation than the accuracy of age data is the completeness of the recording of deaths. We have reviewed several direct investigations of completeness in Chapter 1; they tended to cluster in a range of around 95 percent. There are also indirect tests of registration completeness that can be applied to the SRS data. These tests compare certain demographic features of the population--particularly its age structure and growth rate--to recorded numbers of deaths. We have principally relied on two methods. One is the Brass (1975) method, which basically compares the slope of the age distribution with that implied by recorded mortality conditions and by an inferred growth rate assumed to be constant at each age. Given a certain growth rate, a steeper age distribution should be associated with higher mortality. If the steepness exceeds that implied by registered deaths, then deaths are assumed to be under-reported. The second method, that of Preston and Coale (Preston et al., 1980), basically compares the number of persons above a certain age to the number implied by registered deaths together with an assumed constant growth rate above that age. The starting and terminal ages for applying the techniques can be varied, and different completeness levels are associated with different combinations.

Table 20 shows the results of applying these two methods to all-India data, exclusive of Bihar and West Bengal, for which data are not available. For the Brass procedure, data for three different age ranges were used

TABLE 19 Age-Specific Death Rates and Certain Life Table Functions Computed for Unadjusted SRS Data: All-India[a]

	1971			1972-73			1976		
Age	M(x)	l(x)	E(x)	M(x)	l(x)	E(x)	M(x)	l(x)	E(x)
Males									
0	.14282	100000	50.193	.14650	100000	48.927	.13671	100000	49.118
1	.02337	87100	56.589	.02460	86800	55.329	.02547	87600	55.036
5	.00450	79450	57.918	.00490	78799	56.820	.00430	79259	56.696
10	.00210	77682	54.179	.00210	76892	53.168	.00240	77573	52.874
15	.00190	76871	49.725	.00230	76089	48.702	.00250	76648	48.482
20	.00300	76144	45.176	.00290	75219	44.237	.00270	75696	44.061
25	.00300	75010	40.821	.00315	74136	39.846	.00310	74681	39.626
30	.00390	73893	36.400	.00430	72977	35.439	.00420	73532	35.206
35	.00550	72466	32.067	.00535	71425	31.155	.00450	72004	30.900
40	.00740	70500	27.892	.00810	69539	26.932	.00950	70402	26.546
45	.01050	67939	23.849	.01210	66779	22.942	.01210	67135	22.716
50	.01900	64464	20.000	.01815	62857	19.218	.01950	63193	18.977
55	.02460	58617	16.745	.02675	57401	15.807	.02860	57318	15.666
60	.03700	51825	13.612	.04295	50205	12.714	.04840	49668	12.694
65	.05380	43049	10.878	.05885	40469	10.172	.05760	38946	10.500
70	.11030	32842	8.482	.12060	30088	7.818	.11460	29141	8.192

Females

0	.14282	100000	49.356	.15830	100000	47.108	.15021	100000	50.965
1	.03009	87100	55.629	.03077	85850	53.831	.02463	86500	57.881
5	.00490	77417	58.430	.00550	76107	56.563	.00510	78517	59.638
10	.00210	75543	54.817	.00250	74043	53.070	.00250	76540	56.114
15	.00300	74754	50.370	.00345	73123	48.706	.00290	75590	51.788
20	.00430	73641	46.093	.00495	71872	44.510	.00410	74501	47.508
25	.00430	72075	42.041	.00490	70115	40.563	.00460	72990	43.440
30	.00520	70542	37.900	.00595	68418	36.507	.00480	71330	39.393
35	.00600	68731	33.832	.00580	66412	32.534	.00500	69638	35.289
40	.00600	66700	29.787	.00705	64514	28.418	.00470	67919	31.119
45	.00850	64728	25.618	.00945	62279	24.348	.00800	66341	26.800
50	.01430	62034	21.622	.01440	59404	20.405	.01260	63740	22.792
55	.01750	57752	18.040	.02150	55276	16.743	.01850	59847	19.112
60	.03270	52911	14.462	.03680	49637	13.361	.03340	54556	15.723
65	.04290	44913	11.591	.05525	41273	10.562	.04640	46147	13.132
70	.10850	36213	8.776	.11750	31255	8.146	.08550	36554	10.922

[a]Excludes Bihar and West Bengal.

TABLE 20 Results of Applying Techniques for Estimating Death Registration Completeness to the SRS Data: All-India

Age Range Used For Fitting	Male 1971	Male 1972-73	Male 1976	Male Mean	Female 1971	Female 1972-73	Female 1976	Female Mean
Brass Estimates of Registration Completeness[b]								
5-65	.824 (.0213)	.924 (.0222)	.960 (.0225)	.902 (.0220)	.826 (.0232)	.945 (.0236)	.775 (.0225)	.849 (.0231)
15-55	.763 (.0186)	.863 (.0199)	.880 (.0208)	.835 (.0198)	.794 (.0220)	.896 (.0222)	.734 (.0216)	.808 (.0219)
5-55	.825 (.0214)	.941 (.0227)	.935 (.0225)	.900 (.0222)	.797 (.0223)	.911 (.0227)	.742 (.0216)	.816 (.0216)
Mean of 9				.879 (.0213)				.824 (.0224)
Preston-Coale Estimates of Regression Completeness Based on Ages 0+ to 70+								
Growth Rate Used								
.021	.851	.915	.927	.898	.804	.893	.753	.817
.022	.888	.953	.966	.936	.838	.930	.784	.851
.023	.926	.994	1.007	.976	.874	.970	.817	.887
Mean of 9				.936				.851

[a]Excludes Bihar and West Bengal.
[b]Implied growth rate in parentheses.

for fitting purposes. The maximum range allowed by the data is 5-65. However, the clustering of points shows a departure from a straight line of the point corresponding to the highest age; the age range of 5-55 is probably most satisfactory, in view of the age misreporting problems in the teenage years described above. The Brass results show a range of about 7 points of completeness, depending on the fitting ages chosen, with the preferred age range giving intermediate results. The implied growth rates are highly satisfactory. The mean of the nine growth rates for females is .0224, which is exactly the recorded intercensal growth rate for females during 1971-81. For males the mean implied growth rate is .0213, compared with an intercensal rate of .0218. The consistency of these rates adds validity to the results of applying the method.

Table 20 also shows completeness estimates derived from the Preston-Coale procedure for growth rates in the range of .021 to .023. The results are quite sensitive to the growth rate chosen, but the range of estimates is rather consistent with that of Brass. The interpolated mean value at an r of .0224 for females is .865, and at an r of .0218 for males it is .928. These are about 5 points and 3 points higher, respectively, than the Brass results for the age range 5-55. A reasonable explanation of the relatively small difference is that the Brass results are somewhat more biased in a downward direction by declining mortality (Preston, et al., 1980), which has certainly occurred in India. However, the decline has not produced a set of age-specific growth rates that differ so sharply from constancy, at least during 1961-71, that the procedures would give seriously misleading results (say, by as much as 15 points). At the same time, the Preston-Coale results are biased upward by age overstatement more than Brass's (Preston, et al., 1980). This could also explain the small discrepancy between the two sets of results, although, as noted above, it is not clear that age overstatement is a more serious problem in India than age understatement. Leaning toward the former explanation of the discrepancy, we adopt .87 for females and .93 for males as our best estimate of death registration completeness during the first half of the 1970s in the SRS. The very wide range of estimates presented in Table 20, however, precludes a great deal of confidence being attached to these figures. An additional test of their adequacy is performed in the simulations presented in the final chapter.

Both the Brass and the Preston-Coale results imply more complete male than female death registration. Differences tend to be on the order of 3 points for the age range 5-55 (Brass), or an r of .022 (Preston-Coale), except in the 1976 data, for which it is about 19 points. Completeness for females in 1976 is estimated to be unusually low. This results not from an unusually low crude death rate for females but from unusually low rates at ages over 65, a feature that also appears to some extent in 1977 age-specific data (India, Registrar General, 1980b). Female registration in 1972-73 does appear to be quite high relative to that of other years. Ignoring the 1972-73 estimates, both the Brass and Preston-Coale results show a deterioration of 6 points in completeness for females between 1971 and 1976 and an improvement of 8-11 points for males. The disparate trends for males and females are implausible. We are inclined to ascribe the year-to-year fluctuations to actual fluctuations in mortality, which apparently remain considerable in India. Were we able to observe actual yearly growth rates in the Preston-Coale technique, rather than annual averages over an intercensal period, the completeness estimates would probably be less variable. The high 1972-73 completeness estimates, for example, may reflect the serious harvest problems of the 1972-73 period, when food grain consumption per capita declined by 9 percent from its value during 1971-72 (World Bank, 1978). While our yearly estimates of completeness are probably contaminated by yearly deviation of the data from our assumptions, there is no reason to think that the average of yearly estimates is biased by such problems. We conclude that the completeness of death registration in the SRS during the period 1971-76 was about 90 percent, was about 6 points higher for males than for females, and was not exhibiting a clear-cut trend during the period.

Extensive work was also undertaken by the panel to investigate the completeness of the SRS death registration by state. An initial study, using mainly the Brass and Preston-Coale procedures, concluded that death registration completeness in 1969-71 and 1970-72 seemed conclusively to be below the all-India average only in Bihar and West Bengal (Preston et al., 1979). The Registrar General obviously concurred in this assessment because he stopped including these states in the all-India death rates (and birth rates) in 1972. The suspicion was also confirmed for Bihar for 1979, when results from the

new sample areas in the SRS were presented for the first time. Bihar's crude death rate in the new sample area was 15.1, compared with 13.0 in the old (Table 18). Other states showed very minor differences between results for the old area and those based on old and new ones. Death registration completeness in the remaining states did not seem to differ substantially from the all-India average.

Subsequent work has tended to confirm the lack of sharp regional differentiation in completeness of death registration. However, state results are generally too variable over time and by sex, as well as with regard to the method and age range chosen, to allow very firm conclusions to be drawn on this score.[12] Part of the variability results from the small numbers of deaths involved. A quinquennial age group in a state-period combination typically has fewer than 10 deaths, and quite often 1-3. It should also be recognized that a state's estimate of completeness is biased if net immigration or emigration is occurring, a problem not present at the national level.

The mean completeness estimates for states during 1970-71, 1972-74, and 1975-76 using the Brass and Preston-Coale procedures for males and females are shown in Table 21. The years, methods, and sexes are grouped in order to provide maximum robustness and because little validity could be attached to variation in any of these dimensions by state. Table 21 suggests that there is relatively little variation among the states from the all-India average of .90 presented above. No state is as much as 12 points below this average, and of course any estimate of greater than 1.00 is to be credited to error in the data or the assumptions. Furthermore, it should be observed that for no state-sex-method combination for the period did the estimate ever fall below .72, and that each state had one sex-method combination at least as high as .85. Therefore, we find little basis in these results for differentially adjusting the states for incompleteness of death registration.

Estimates of crude birth rates are clearly a by-product of the estimates of death registration completeness. The connection is most immediate for the Preston-Coale procedure, in which the value of the growth rate used as input to the procedure can simply be added to the corrected death rate in order to estimate the crude birth rate. This procedure produces birth rate estimates that are quite insensitive in India to estimates of the growth

TABLE 21 Estimates of SRS Death Registration Completeness, 1970-76: Selected States of India

State	Mean of Completeness Estimates for Males and Females; Using Brass and Preston-Coale Procedures; Applied to 1970-71, 1972-74, and 1975-76
Andhra Pradesh	.90
Assam	1.17
Gujarat	.87
Haryana	.92
Karnataka	.89
Kerala	1.00
Madhya Pradesh	.79
Maharashtra	.82
Orissa	1.00
Punjab	1.04
Rajasthan	.79
Tamil Nadu	.85
Uttar Pradesh	.93

rate, because higher values for r will raise completeness estimates more or less proportionately, and hence reduce the corrected death rate to which it is added (Preston and Hill, 1980). Ironically, as a result of these offsetting tendencies, birth rate estimates are much less sensitive to errors in the assumed growth rate than are death rate estimates.

Table 22 shows all-India estimates of crude birth rates derived in this fashion. Growth rates in the range of 21 to 23 per 1,000 are used because there is good evidence from censuses that the true growth rate falls within this range. Variation of 2 per 1,000 in the input growth rate results in variation in the estimated birth rate of only 0.5 per 1,000. Application of the procedure to results for 1971, 1972-73, and 1976 indicates a very small decline of only about 0.3 per 1,000 in crude birth rates regardless of which input growth rate is chosen. This procedure thus indicates a relatively stable crude birth rate in the range of 39.0-39.5 during the first half of the 1971-81 decade. If completeness estimates were biased by as much as 5 percent (e.g., from declining

TABLE 22 Estimate of Crude Birth Rates Based on SRS Registered Deaths and Estimates of Death Registration Completeness: All-India[a]

Assumed Growth Rate	Estimate of Death Registration Completeness, Age 0+ Based on Preston-Coale Method (mean, male and female)	Recorded Crude Death Rate, SRS (per 1,000)	Implied Crude Birth Rate
(1)	(2)	(3)	(4)=(1)+(3)/(2)
1971			
21/1,000	.827	15.05	39.2
22/1,000	.863	15.05	39.4
23/1,000	.900	15.05	39.7
1972-73			
21/1,000	.904	16.2	38.9
22/1,000	.941	16.2	39.2
23/1,000	.982	16.2	39.5
1976			
21/1,000	.840	15.0	38.9
22/1,000	.875	15.0	39.1
23/1,000	.912	15.0	39.4

Note: Excludes Bihar and West Bengal.

mortality or age misstatement), the estimate of the crude birth rate would be in error by about (15-15/1.05) = 0.7 per 1,000.

The above procedure can also be applied to the data for states. There is greater potential for error in state-specific estimates because of the smaller numbers in the SRS and because states have a greater capacity for violating assumptions, particularly the assumption of a closed population. However, the procedure is one of the very few available for providing estimates of birth rates beyond the 1971 census that is independent of the SRS birth registration. Table 23 shows the results of making state-specific estimates for 1975-76, the latest year for which they are available.[13] Results are quite similar in level and geographic pattern to those made for 1969-71 (Preston et al., 1979). They generally embody the higher

TABLE 23 Crude Birth Rate Estimates in 1975-76 by State, Implied by Estimates of Death Registration Completeness in the SRS: Selected States of India

State	Growth Rate Estimated from Brass Procedure, Ages 5-50 (per 1,000)	Completeness Estimated From Preston-Coale Procedure, Using Growth Rate in (1)	Mean Death Rate 1975-76	Estimated Crude Birth Rate
	(1)	(2)	(3)	(4)=(1)+(3)/(2)
Andhra Pradesh	16.4	.797	14.85	35.1
Assam	26.0	1.082	15.9	40.7
Gujarat	24.15	.834	15.35	42.5
Haryana	26.34	.851	12.55	41.0
Jammu and Kashmir	20.45	.781	12.05	35.9
Karnataka	22.45	.797	11.4	36.7
Kerala	27.05	1.012	8.25	35.2
Madhya Pradesh	18.4	.765	17.5	41.3
Maharashtra	22.15	.834	11.35	35.8
Orissa	17.55	.937	16.75	35.4
Punjab	25.05	.979	10.9	36.2
Rajasthan	22.95	.739	15.3	43.7
Tamil Nadu	17.15	.873	14.8	34.1
Uttar Pradesh	18.7	.894	21.55	42.8

Note: All figures refer to the mean of males and females.

fertility pattern of northern India that appears elsewhere in this report. A more extensive discussion appears in Chapter 2, Section 2.3; here we should caution that net internal migration is influencing the results in unpredictable ways, depending on its direction, age-incidence, and persistence. Generally, net emigration biases upward estimates of birth rates made by the procedure used here, because the inferred growth rate equals the actual crude rate of natural increase plus the crude rate of net emigration. We should stress that the estimates of birth rates in Table 23 are believed to be more robust than estimates of completeness or of death rates, and we caution against acceptance of the completeness estimates at face value.

2.3 FERTILITY

2.3.1 All-India Estimates

There are four major sources of information on fertility in India: intercensal analysis, which is discussed in Chapter 3; SRS tabulations of crude birth rates, general fertility rates, and occasionally age-specific fertility rates; the 1972 Fertility Survey, conducted on SRS sample areas; and the 1979 Child Mortality Survey, also conducted on SRS areas.

Of these systems, the SRS is doubtless the most important because of its continuous generation and timely presentation of data. Table 24 presents crude birth rates from the SRS since 1970. Because of their importance, much of this section focuses on evaluating the quality and particularly the completeness of the SRS data. The main attempts at direct evaluation, summarized above, cover a very small fraction of the SRS experience. The additional tests compare SRS-based rates with those produced by the other sources mentioned. Unfortunately, direct comparisons are not possible with intercensal procedures, since the SRS was only partially functioning during the 1961-71 decade and the 1981 census results are not yet available in the necessary detail.

Needless to say, the 1972 and 1979 surveys are not themselves unimpeachable sources. In fact, each of them is subject to serious problems that reduce their utility. Both surveys asked questions both on number of children born in a woman's lifetime and on births that occurred in the year preceding the survey. These questions allow an

TABLE 24 Unadjusted Crude Birth Rates from the Sample Registration System: Selected States and All-India

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1979[a]
Andhra Pradesh	35.4	34.8	35.8	31.6	34.6	34.9	33.7	32.3	33.6	31.9	32.1
Assam	38.8	38.5	36.4	33.3	32.8	30.1	32.8	30.1	30.8	32.4	33.8
Bihar	32.0	32.8	33.1	31.4	28.7	27.7	31.1	30.1	31.2	32.0	38.4
Gujarat	41.0	40.0	40.2	35.4	38.4	37.0	37.4	36.1	35.8	35.7	34.9
Haryana	36.2	42.1	40.5	39.4	39.5	38.0	36.3	34.6	33.5	36.4	36.6
Karnataka	33.0	31.7	31.5	28.9	28.0	27.7	29.4	26.3	29.2	28.9	28.1
Kerala	31.6	31.1	31.2	29.2	26.8	28.0	27.8	25.8	25.2	26.1	25.8
Madhya Pradesh	39.3	39.1	39.3	37.4	36.6	40.3	39.8	38.3	37.2	37.8	37.8
Maharashtra	31.5	32.2	32.2	28.8	29.0	29.7	29.3	26.2	26.9	27.1	27.2
Orissa	38.1	34.6	34.5	34.8	33.6	33.6	34.8	29.9	32.9	32.4	31.0
Punjab	33.8	34.2	34.6	33.4	32.0	31.8	31.6	31.0	29.4	29.3	28.7
Rajasthan	38.5	42.4	42.4	38.1	36.3	36.9	33.4	33.8	35.5	35.2	35.5
Tamil Nadu	30.0	31.4	32.4	30.0	29.2	30.7	30.7	29.8	28.8	28.1	28.9
Uttar Pradesh	45.4	44.9	43.2	41.7	42.1	43.1	40.0	40.3	40.4	39.6	39.6
West Bengal	27.8	--	--	--	28.0	28.7	31.9	32.1	28.4	--	32.7
All-India (except Bihar and West Bengal)	36.8	36.9	36.6	34.6	34.5	35.2	34.4	33.0	33.3	33.2	33.1
All-India (weighted average including Bihar and West Bengal)	35.9	--	--	--	33.4	33.9	33.8			--	33.7[b]

[a] "Pooled" estimates incorporating new SRS sample areas. Figures for Bihar and West Bengal refer only to new areas.

[b] Direct estimate presented in SRS Bulletin.

Sources: India, Registrar General, Sample Registration Bulletins: Vol. XV(1), June 1981; Vol. XIII(1), June 1979; Vol. XII(1), June 1978; Vol. XI(1), January 1977; Vol. IX(3), July 1975.

evaluation of the consistency of the two results and often suggest adjustment procedures. In the 1979 survey, however, there is reason to suspect that both pieces of information are biased downward, relative to the 1972 survey, so that consistency may give a spurious appearance of accuracy. In particular, as noted above, the cumulative fertility questions were limited to "total children born alive" and "total children surviving," without additional probes asking about children living at home and away and children who have died. Such probes were included in the 1972 survey. With regard to births in the last year, the 1979 survey of SRS households, conducted by the SRS supervisors, did not include births occurring in the past year that were recorded by the enumerator but missed by the supervisor (India, Registrar General, 1980a:20). As a result, the survey crude birth rate for 1978 for all-India (except Bihar and West Bengal) is 32.5, compared with the 33.3 of the SRS itself. There was more contamination of the two sources in the 1972 survey. Births missed by the supervisors but caught by the enumerators were included (Jain and Adlakha, 1982). The Registrar General has also informally indicated that some adjustments were made to the SRS estimates as a result of data becoming available in the 1972 Fertility Survey. These adjustments may account for the fact that the SRS half-yearly crude birth rates for the second half of 1971 and the first half of 1972 (i.e., the period covered by the survey) were the highest ever recorded for all-India in the respective half-yearly series. This contamination clearly reduces the value of the 1972 Fertility Survey as an independent source with which to evaluate the SRS, although it has probably increased the internal quality of the survey data themselves.

The main problem with the 1972 survey is not the manner in which questions were asked but who was asked. The survey was to be administered to a sample of ever-married women, but the marital distribution is out of line with that of the 1971 census. Depending on its source, this discrepancy could seriously affect the interpretation of results from the survey. On the other hand, the comparison of the marital distribution from the 1979 survey with the sample distribution from the 1981 census shows only minor variations.

The disparity between marital distributions in the 1971 census and 1972 survey is shown in Table 25. At all ages below 40 and especially at ages 15-19, the 1972 Fertility Survey has a lower proportion married. Such a

TABLE 25 Female Marital Distributions from the 1971 Census and 1972 Fertility Survey: All-India

Age Group	Percent Currently Married	
	1971 Census[a]	1972 Fertility Survey[b]
15-19	55.4	41.1
20-24	88.4	83.7
25-29	95.0	92.3
30-34	94.1	90.3
35-39	91.4	88.6
40-44	84.2	86.7
45-49	78.2	97.9
10+	64.4	60.6

[a]Source: India, Registrar General (1977a).
[b]Derived by dividing age-specific fertility rates by age-specific marital fertility rates presented in India, Registrar General (1976b). The figure for 10+ was directly available. The anomaly at 45-49 is unexplained; it may result from the allocation of births at 50+ to ages 45-49 in age-specific fertility rates but not in marital fertility rates.

rapid change in behavior is totally implausible and nearly mathematically impossible at ages 15-19. There would seem to be three possible explanations of the difference:

(1) Too few women were administered the 1972 survey instrument in the SRS areas.
   (a) These women were randomly distributed with regard to fertility.
   (b) These were, disproportionately, childless women whom the survey takers believed could be skipped.
(2) A real difference exists in marital distribution (but not necessarily in marital fertility) between the SRS areas and the national average.

Explanations (1a) and (2) imply that marital fertility rates recorded in the 1972 Fertility Survey may be appropriate for all-India, whereas age-specific fertility rates (i.e., those for all women regardless of marital status) would be too low in the SRS. Explanation (1b), which is perhaps most plausible, implies that total fertility rates in the SRS would be roughly correct (the upward bias in marital fertility rates compensating for the downward bias in proportions married), whereas marital fertility rates in the SRS would be too high. The basic point is that marital fertility and total fertility rates in the survey cannot both be correct because they imply a marital distribution that is inconsistent with that of all-India.

Application of a standard procedure for correcting age-specific fertility rates for biases of various sorts indicates that final results are not heavily dependent on which set of fertility rates--age-specific or marital--we initially accept from the 1972 Fertility Survey. The method referred to is the P/F method developed by Brass (Brass and Coale, 1968). It compares the mean reported number of children ever born to women, by age, to the number they would have it they had borne children at the age-specific rates reported in the survey.

We have performed this comparison twice. In the first case (A) we have accepted the age-specific fertility rates of the 1972 Fertility Survey and the marital distribution implied therein (as appropriate for explanation 1b above).[14] In the second case (B, appropriate for explanations 1a and 2), we have accepted the marital fertility rates of the survey together with the proportion married from the census. Note that the respective marital distributions pertain both to the currently married, who are reporting births in the year before the survey, and to the ever-married, who are reporting lifetime births. To select the currently married from one source and the ever-married from the other would imply that the post-married distributions, which are consistent between the sources, are erroneous in both.[15]

Results of the P/F procedure, presented in Table 26, show that, when the marital distibution of the survey is accepted, there is a high degree of consistency between the cumulative parities reported by women in the survey (P) and their reported births in the year preceding the survey (F). Results at ages 15-19 are usually unreliable because childbearing is just beginning; results at high ages become suspect because older women may not report children ever born as completely as younger women,

TABLE 26 Application of the P/F Method to Data from the 1972 Fertility Survey and the 1971 Census: All-India

Age Interval	Mean Parity of All Women P(i)	Births per Woman in Year Preceding Survey f(i)	Births That Would Occur by End of Age Interval According to f(i) Schedule Q(i)	Estimated Mean Births per Woman Based on Q(i)[a] F(i)	P(i)/F(i)
	(1)	(2)	(3)	(4)	(5)
A. Using Marital Distribution of Fertility Survey					
15-19	.1649	.0873	.4365	.1848	.892
20-24	1.2062	.2619	1.7460	1.1858	1.017
25-29	2.6481	.2761	3.1265	2.5905	1.022
30-34	3.7862	.2169	4.2110	3.8085	.994
35-39	4.6003	.1428	4.9250	4.6590	.987
40-44	5.0615	.0755	5.3025	5.1436	.984
45-49	5.0735	.0292	5.4485	5.4144	.937

B. Using Marital Distribution of 1971 Census

15-19	.2218	.1181	.5905	.2604	.852
20-24	1.2794	.2781	1.9810	1.3923	.919
25-29	2.7224	.2842	3.4020	2.8508	.955
30-34	3.9369	.2256	4.5300	4.1123	.957
35-39	4.7320	.1472	5.2660	4.9955	.947
40-44	5.0507	.0731	5.6315	5.4907	.920
45-49	5.0469	.0230	5.7465	5.7196	.882

Note: Rural and urban values of P(i) and F(i) were combined using the 1971 census rural-urban distribution of women by age.

[a]Conversion from Q(i) to F(i) is accomplished by using equations presented in United Nations (1983:Ch. 3).

especially if a child has died or left home. For the key ages of 20-34, the mean value of P/F is 1.011. Multiplying the total fertility rate of 5.4485 implied by reported births last year by this adjustment factor of 1.011 gives a corrected total fertility rate of 5.51 for 1971-72. It is possible, indeed likely, that declining fertility at young ages has biased P/F upward to some extent at ages 20-34, since the cumulative childbearing reflected in P is higher than that in the year preceding the survey, reflected in F. The major point is clearly that reported births in the year preceding the survey show very little need for correction based on cumulative fertility reports.

This consistency disappears, however, when marital fertility rates from the survey and cumulative fertility for ever-married women from this source are applied to the respective marital distributions from the 1971 census. Because the census shows a higher proportion currently married than the survey, but a relatively similar proportion ever-married at higher ages, F is raised more than P and P/F declines. The new total fertility rate becomes 5.75 instead of 5.45 when the survey marital distribution is accepted. This comparison suggests that either P is too low or F is too high. The mean value of P/F at ages 20-34 is .944. If we accept P as the more valid of the two measures at this age, which is the customary assumption, then the corrected total fertility rate is 5.747 (.944) = 5.43. Once again, this figure may be biased upward slightly by declining fertility.

Thus, there is good agreement between the two sets of results of applying the P/F method to the 1972 Fertility Survey data, regardless of whether the marital distribution from the survey or from the census is adopted. The suggested range of the total fertility rate is 5.4 to 5.5 in 1971-72. This figure differs from that of others who have examined the same data set. First, Jain and Adlakha (1982) accept the figure of 5.75 given from case B in Table 26. This choice means that they have discarded the P/F results showing that births in the year preceding the census are too high relative to lifetime births when the census marital distribution is used. Presumably, they believe that P is biased downward. Second, Dyson (1979b) develops estimates in the range of 5.8 to 5.9 by taking the ever-married distribution from the census and accepting the currently married distribution from the survey (that is, he does not adjust the survey marital fertility rates for differences between the census and survey marital distributions). In effect, he draws the Pi values

from case B in Table 26 and the Fi values from case A. The ambiguities surrounding the P/F application--marital distributional anomalies, biases from declining fertility, ever-present age misreporting, and other problems--prevent reaching results to which one can attach a high degree of confidence. In the next section we present state-specific results, which clarify certain of the all-India results just reported.

The P/F procedure was also applied to data from a 25-percent sample of the 1979 survey. Two cautionary notes are required at the outset. First, SRS crude birth rates were clearly exhibiting a decline during the 1970s (Table 24), which biases upward the P/F adjustment factor. Second, as noted above, there is reason to suspect, simply from the way that questions were asked, that both P and F may have been too low in the 1979 survey. The results of the P/F procedure presented in Table 27 show that, except for ages 15-19, cumulative parity is much higher than that implied by births in the year preceding the survey. Contrary to the pattern normally observed in developing countries, the P/F ratio increases with age. This age pattern is consistent with a decline in fertility that is concentrated at older ages. The variability and unusual age pattern of P/Fs provides a very weak basis for developing an adjustment factor that could correct the F series for reference period bias or other deficiencies. If we accepted the mean P/F value at ages 20-34 of 1.097, then the implied total fertility rate would be 4.3025 x (1.097) = 4.72.

An alternate test takes advantage of the data available from the 1972 Fertility Survey to examine the validity of the 1979 survey. Suppose that the Pi's recorded in the 1972 survey are accurate and that childbearing between the 1972 and 1979 surveys occurred at the interpolated mean of the age-specific fertility rates recorded in the 1972 and 1979 surveys. We can then estimate what the mean parity of women would be, by age, in 1979.[16] This procedure enables us to discard the assumption of constant fertility that is required in the P/F procedure. In effect, it compares P in 1979 with an F that amalgamates an earlier P with intersurvey fertility.

Table 28 shows the results of this procedure. The predicted value of P is within 2.2 percent of the actual value in the age range 25-49. At the highest age, P is slightly below predictions, presumably because of a failure to report children ever born in the 1979 survey.

TABLE 27 Application of the P/F Method to Fertility Data from the 1979 Infant Mortality Survey: All-India

Age Interval	Mean Parity of all Women P(i)[a]	Births per Woman in Year Preceding Survey f(i)[b]	Births That Would Occur by End of Age Interval According to f(i) Schedule Q(i)	Estimated Births per Woman Based on Q(i)[c] F(i)	P(i)/F(i)
	(1)	(2)	(3)	(4)	(5)
15-19	.1215	.0658	.3290	.1555	0.781
20-24	1.0019	.2277	1.4675	.9806	1.022
25-29	2.4266	.2306	2.6205	2.1817	1.112
30-34	3.6281	.1613	3.4270	3.1361	1.157
35-39	4.4820	.1063	3.9585	3.7676	1.190
40-44	4.8898	.0471	4.1940	4.0886	1.196
45-49	5.0140	.0217	4.3025	4.2770	1.172

[a]Reproduced as given in India, Registrar General (1980b:14); no information is available on the weighting procedure used in combining rural and urban values.
[b]Rural and urban values were combined using the 1971 census rural-urban distribution by age.
[c]Conversion from Q(i) to F(i) was accomplished by using equations presented in United Nations (1983:Ch. 3).

TABLE 28 Testing the Consistency of Changes in Mean Parities Between the 1972 and 1979 Surveys with the Mean of Age-Specific Fertility Rates Recorded in the Two Surveys: All-India

Age Interval	Mean Parity 1972 Fertility Survey	Predicted Mean Parity 1979 Survey, Based on Column 1 and Mean Inter-survey Rates of Childbearing	Actual Mean Parity, 1979 Survey	Ratio, Actual to Predicted	Predicted Mean Parity if Fertility in 1979 Survey Raised by 5%	Ratio, Actual to Predicted Under Assumed Fertility Inflation
	(1)	(2)	(3)	(4)=(3)÷(2)	(5)	(6)=(3)÷(5)
15-19	.165	--	--	--	--	--
20-24	1.206	1.103	1.002	.908	1.130	.887
25-29	2.648	2.373	2.427	1.022	2.413	1.006
30-34	3.786	3.605	3.628	1.006	3.642	.996
35-39	4.600	4.463	4.482	1.004	4.489	.999
40-44	5.061	4.972	4.890	.984	4.987	.980
45-49	5.074	5.227	5.014	.959	5.234	.958

Below age 25, results are unstable because of rapid changes in fertility with age and because fertility experience is skewed toward the latter part of the intersurvey period. If only 1979 fertility rates are used, for example, the P/F of 1.02 from Table 27 at ages 20-24 would replace the .908 value of Table 28.

So there is a high degree of agreement between the changes in parity from the 1972 survey to the 1979 survey and the mean level of current fertility recorded in the two. The quality of the 1979 survey data on fertility thus passes an important check: consistency with reported parity. However, it should be noted that the test is not a particularly stringent one because only a minority of actual parity in 1979 is determined, through our procedure, by the 1979 survey fertility rates. The 1972 rates, and more important, 1972 parity, also affect predicted 1979 parity. To illustrate, we have arbitrarily inflated the reported 1979 age-specific fertility by 5 percent and repeated the procedure. Column 6 of Table 28 shows that the ratio of actual to predicted 1979 parity is even closer to unity at ages 25-40 than it is with uninflated fertility. Thus, Table 28 is not particularly helpful in deciding whether the 1979 fertility reports are complete or 5-percent incomplete relative to reports in the 1972 survey, although it can effectively rule out a level of 20-percent relative incompleteness if we are prepared to accept the parity values in 1979 (which are very consistent with those of the 1981 census, not analyzed here).

It could be argued that the decline in reported total fertility rates from 5.45 in 1971-72 to 4.30 in 1979 is out of line with trends in the SRS crude birth rates (Table 24). The total fertility rate declined by 21 percent, whereas the reported crude birth rate (all-India except Bihar and West Bengal) declined by only 10 percent between the 1971-72 average of 36.75 and the 1978 figure of 33.3, to which the 1979 survey pertains. Some of the disparity can be accounted for by the fact that fertility declines were largest at the older ages, which receive much heavier weighting in the total fertility rate than in the crude birth rate. At ages 20-34, which are responsible for most of the births in India, the mean decline in age-specific fertility rates between 1972 and 1979 was 18 percent, not 21 percent. Some of the remaining difference may be accounted for by age structural changes. According to the Registrar General (India, Registrar General, 1980a:49), the percentage of India's population

aged 15-59 grew by 7 percent between the 1971 census and the 1979 Fertility Survey, from 52.0 to 55.9 percent. If this figure obtained within the main childbearing years, then it would account for 7 percent of the remaining 8-percent disparity between the crude birth rate trend and the trend in age-specific fertility. This comparison may overstate the age distributional change, however, since the SRS in 1971 already had a somewhat different age distribution than the census wherein 53.4 percent were between exact ages 15 and 60 (unpublished data supplied by the Registrar General). Within the SRS, then, the reported proportion 15-59 grew by 5 percent. But simulations that we have done of India's population, described in more detail in Chapter 4, suggest that even with a fairly rapid fertility decline the percentage of the population who were women of childbearing ages (15-44) probably grew by no more than 3 percent between the 1972 and the 1979 surveys. There appear to be some anomalies in the reported SRS age distributional changes, perhaps resulting from improved age reporting as units have remained in the system.

If we accept the crude birth rate trends in the SRS--which implies that we believe birth registration completeness to be about the same in 1978 as in 1971-72--then the decline in total fertility rates between these dates in the surveys is implausible. Of the 11-percent disparity in trends, 3-5 percent could be attributable to age distributional changes or to the age pattern of fertility declines, but the remaining 6-8 percent would reflect greater incompleteness of fertility reports in 1978 relative to 1972. This would be consistent with the failure of the 1979 survey to include births that were found by the enumerator but not by the supervisor. The lower end of the range is also reasonable with regard to the exercise above that compared Ps and Fs from the two surveys. The next section takes up some additional considerations of fertility levels for all-India.

2.3.2 Fertility Estimates by States

Sources for estimating fertility rates by state are the same as those available at the all-India level, except that the 1979 survey results are not available by state. Intercensal estimates are reported in Chapter 3; in this section we focus on results from the 1972 Fertility Survey. It should be noted that, despite the large size

of this survey, problems of a relatively small sample size for births last year may be encountered at the state level for women at particular ages.

Table 29 presents the results of applying the P/F procedure to state data from the 1972 Fertility Survey. We have used the age-specific fertility rates and implied marital distribution from the SRS, as in case A of Table 26. Obvious typographical errors were corrected.[17]

Whereas the mean P/F for all-India at ages 20-34 was 1.01, there is clearly variation about this value at the state level. Values range from .91 in Madhya Pradesh, implying about a 9-percent overreporting of current fertility, to 1.27 in Karnataka. P/F values at different ages in the same state are reassuringly stable, varying by more than 10 percentage points only in Kerala and Punjab. Both of these states show rising P/F values with age, consistent with a fertility decline. The likelihood of a decline is confirmed by changes in the child-woman ratio between the 1961 and 1971 censuses, also shown in Table 29. Kerala has a decline of 14 percent and Punjab of 16 percent, by far the largest changes shown in the table. Since P/F is biased upward by fertility decline, there is solid reason for rejecting the relatively high correction factor implied for these states.

A second test of the adequacy of the 1972 Fertility Survey reports on births in the previous year is to compare them with results from the SRS itself, bearing in mind that the two sources are not independent. Unfortunately for comparative purposes, the 1972 Fertility Survey and the SRS did not provide identical fertility measures for the mid-1971 to mid-1972 period. The 1972 Fertility Survey provided state-specific general fertility rates for the period, and the SRS provided crude birth rates. However, the SRS also published general fertility rates for calendar years 1971 and 1972 as well as crude birth rates for those years. For comparative purposes, we have converted the SRS crude birth rates for mid-1971 to mid-1972 into general fertility rates for that period by using the mean ratio of these indices, by state, for calendar years 1971 and 1972. The ratio of crude birth rates is taken from SRS publications, as is the general fertility rate for 1971-72. Urban and rural rates are weighted by their respective state-specific proportions in the 1971 census. The results are shown in Table 30.

In most states, the two sets of rates are very close to one another; in only three states are the differences

larger than 3 percent. This consistency may not reflect the accuracy of the two sources, since as noted they are not operationally independent. It is at least useful to know that tests applied to the 1972 Fertility Survey data can be assumed to pertain closely for most states to the SRS figures for the same dates; however, for three states serious inconsistency emerges. In Karnataka and Uttar Pradesh, the 1972 Fertility Survey gives general fertility rates that are 9 to 10 percent lower than the SRS rates for comparable dates; in Madhya Pradesh the 1972 Fertility Survey rate is 13 percent higher. Also shown in Table 30 is the percentage difference between general fertility rates from the 1972 Fertility Survey and the SRS general fertility rate for 1970-73. The differences are in general much larger. This disparity may reflect unusually high fertility from mid-1971 to mid-1972 or more complete recording of events in the 1972 Fertility Survey than was typical for the 1970-73 period of the SRS.

In Karnataka, the shortfall in 1972 Fertility Survey births relative to SRS births agrees with the high value of P/F from Table 29. Likewise in Madhya Pradesh, the excess of 1972 Fertility Survey births relative to those of the SRS agrees with the unusually low value of .905 for P/F, suggesting overreporting of births in the 1972 Fertility Survey, presumably from reference period bias. There is no such agreement between the sources for Uttar Pradesh, but, as Table 30 shows, SRS results for the state from mid-1971 to mid-1972 are anomalous relative to the whole 1970-73 period, and P/F is not out of line with these latter results. Table 30 for the 1970-73 period also tends to weakly confirm the possibility indicated by P/F of overreporting of births for Gujarat and Haryana and of underreporting of births for Orissa. The only state for which there is substantial disagreement between Table 30 and P/F results is Maharashtra, inasmuch as P/F there shows a 5-percent deficiency of births in the 1972 Fertility Survey, but 1972 Fertility Survey births exceed those for the SRS in the 1970-73 period by 9 percent. It may be, of course, that both indications are correct and that 1972 Fertility Survey births are 5 percent too low and that the SRS births are even lower.

It appears that, except for Kerala and Punjab, in which declining fertility has biased the P/F upward, the P/F procedure provides a reasonable basis for adjusting 1972 Fertility Survey births. Note that the adjustment is less than 5 percent in 7 of the 12 other states. The total fertility rates and the crude birth rates that

TABLE 29 Cumulative Fertility Compared with Current Fertility via the P/F Method, 1972 Fertility Survey, by State: Selected States and All-India

State	Total Fertility Rate, 1972 Fertility Survey[a]	P/F				Percentage Change in Ratio, Children Aged 0-4 to Women Aged 15-44 Between Census of 1961 and 1971[b]	Corrected Total Fertility Rate, 1971-72 Column 1 x Column 5	Corrected Crude Birth Rate 1971-72[c]
		20-24	25-29	30-34	Mean			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	4.656	1.022	1.038	1.029	1.030	+2	4.80	36.7
Assam	5.529	1.105	1.187	1.155	1.149	+3	6.35	43.4
Bihar	4.931	0.904	1.009	.978	.964	-3	4.75	33.2
Gujarat	6.131	.950	.976	.997	.974	-7	5.97	42.0
Haryana	6.894	.979	.952	.958	.963	-7	6.64	43.3
Karnataka	4.327	1.232	1.247	1.330	1.270	-1	5.50	35.9
Kerala	4.492	1.056	1.166	1.146	1.123	-14	4.49[d]	32.6[d]
Madhya Pradesh	6.808	.902	.923	.889	.905	-2	6.16	40.8
Maharashtra	4.697	1.045	1.059	1.041	1.048	-1	4.92	35.2
Orissa	4.819	1.200	1.160	1.086	1.149	+8	5.54	39.6
Punjab	5.574	1.020	1.132	1.115	1.089	-16	5.57[d]	35.9[d]
Rajasthan	6.629	1.015	.919	.957	.963	+1	6.38	42.3
Tamil Nadu	4.178	1.101	1.106	1.084	1.097	-2	4.58	35.4
Uttar Pradesh	7.086	1.026	.948	.942	.972	+4	6.89	44.5

State-weighted estimate, All-India (except Bihar and West Bengal)	5.68[e]	39.3
All-India (except West Bengal)	5.57[e]	38.7

[a]Source: India, Registrar General (1976b). Urban and rural age-specific fertility rates are applied for women at each age to the urban-rural distribution from the 1971 census. Marital distributions are those of the 1972 survey, derived as in Notes 14 and 17 of Chapter 2.

[b]Dyson (1979b).

[c]The general fertility rate of the 1972 Fertility Survey is multiplied by the ratio of crude birth rates 1971-72 to the general fertility rate, 1971-72, from the SRS, by state. The resulting estimated 1972 Fertility Survey crude birth rate is multiplied by the P/F from column 6. No general fertility rate estimate is available for Bihar from the SRS; the proportion of the Bihar population who are women aged 15-49 in the 1971 census (.2268) is used to convert the 1972 Fertility Survey general fertility rate into the crude birth rate. In Uttar Pradesh, the proportion of population who were women aged 15-49 in the 1971 census was used for the conversion because the implied SRS value was implausibly lower than in any other state and showing the largest discrepancy from census values.

[d]Uncorrected.

[e]Weighted by number of women aged 15-49 in 1971 census.

TABLE 30 Comparison of General Fertility Rates from the 1972 Fertility Survey to Those in the SRS: Selected States of India

State	General Fertility Rate, Mid-1971 to to Mid-1972, from the 1972 Fertility Survey	Percentage Excess (+) or Deficit (-) of the General Fertility Rate from the 1972 Fertility Survey Compared with the SRS Rate	
		Mid-71 to Mid-72	1970-73
Andhra Pradesh	149.9	-0.6	2.8
Assam	177.2	-2.9	2.2
Bihar	152.9	--	--
Gujarat	187.2	2.7	10.5
Haryana	208.5	0.0	9.9
Karnataka	131.6	-9.2	-7.8[a]
Kerala	131.6	-2.3	7.3[a]
Madhya Pradesh	211.8	12.7	18.0
Maharashtra	147.4	0.0	8.7
Orissa	149.9	-2.7	-2.7
Punjab	159.8	-0.7	4.4
Rajasthan	201.1	-0.3	--
Tamil Nadu	129.3	-1.3	4.2
Uttar Pradesh	213.6	-9.7	-1.6

[a]Denominator based on 1971-73 only.

Source: India, Registrar General Sample Registration Bulletin (various issues); and unpublished data supplied by the Registrar General.

result from multiplying the original values of these variables by P/F are shown in Table 29. Before accepting these as final estimates, of course, it is necessary to compare them to estimates derived from other sources. At this point it should be noted that Bihar's estimated crude birth rate and total fertility rate are almost surely too low in Table 29; evidently, the problems associated with SRS operations in Bihar extended to the 1972 Fertility Survey. The same seems true of West Bengal, which participated in the survey but for which no data on the volume of fertility in rural areas were published.[18]

The state-weighted total fertility rate for all-India (except West Bengal) in Table 29 is 5.57, compared with 5.51 using comparable procedures in Table 26. This difference is surely tolerable; however, when Bihar is excluded from the calculations in Table 29 the state-weighted estimates rise to 5.68. The below-average fertility of Bihar in the 1972 Fertility Survey is simply

not credible: Table 24 shows that Bihar had much higher fertility than all-India in 1979, when SRS results from the new sample area in Bihar were reported for the first time; likewise, intercensal analysis reported in Chapter 3 shows Bihar to be a moderate to high-fertility state.

On the other hand, there is reason to believe that the P/F procedure results in too high a TFR in Uttar Pradesh. As we show in the next chapter, the TFR for the state based on 1961-71 population change is only 6.45 (mean, forward, and reverse survival). It seems unlikely that fertility could have risen to 6.89 by 1971-72, and other evidence in Chapter 4 shows that an Uttar Pradesh level of 6.89 in 1971-72 produces too high a TFR for all-India as well. One source of the problem may be that age-specific (but not overall) fertility and parity could be too high at young ages in Uttar Pradesh because of an unusually strong tendency (suggested by the age distribution) for unmarried or nulliparous women to be reported below age 15 or 20. So in deriving TFR as a state-weighted average for all-India, we have used a TFR value of 6.45 in Uttar Pradesh. This reduces the value of the all-India (except Bihar and West Bengal) TFR to 5.59; including an adjustment so that Bihar and West Bengal are represented raises the all-India TFR to 5.60. This figure of 5.60 for India's TFR in 1971-72 is tentatively adopted. The all-India CBR (without Bihar and West Bengal) of 39.3 is adopted for all-India including these states, since Chapter 3 results imply that the inclusion of these two states has a small and unsystematic effect on the aggregate crude birth rate.

If the crude birth rate estimate of 39.3 in 1971-72 is correct, it implies that the SRS results are deficient for that period. From Table 24, the mean SRS crude birth rate for all-India (except Bihar and West Bengal) in 1971 and 1972 was 36.75. This figure implies a deficiency of 6.4 percent in SRS birth rates and a somewhat larger deficiency if Bihar and West Bengal are included. It should be remembered, however, that births in the SRS from mid-1971 to mid-1972 were probably atypically complete because of the operation of the 1972 Fertility Survey itself. The mean of the SRS 1970-73 birth rates (a period that includes one unusually good year and one unusually bad one, 1973) is 36.22, which is deficient by 7.8 percent without Bihar and West Bengal.

We have suggested that the reported total fertility rate of 5.45 births per woman in the 1972 Fertility Survey should be adjusted upward by 2.8 percent to 5.60.

Earlier we argued that births in the 1979 survey are perhaps 6-percent deficient relative to those in the 1972 survey. Together, these pieces of information suggest that the 1979 survey's total fertility rate of 4.3025 for 1978 should be adjusted upward to 4.3025 (1.028) (1.06) = 4.69. The plausibility of this figure is tested in Chapter 4. It is very close to the value (4.72) provided by the simple P/F method.

We can investigate the implied completeness of SRS birth registration by state by comparing SRS birth rates for 1970-73 with those derived on the basis of the 1972 Fertility Survey. Results are shown in Table 31. Incompleteness ranges from 15.3 percent in Assam to 1.6 percent

TABLE 31 Estimated Completeness of SRS Birth Rates by State, 1970-73, and Implied Crude Birth Rate Estimates, 1979: Selected States and All-India

State	Ratio, Mean SRS Crude Birth Rate, 1970-73 to Estimated Fertility Survey Birth Rate, 1971-72	1979 SRS Crude Birth Rate (old sample areas) if Completeness Same as Estimated for 1970-73 (column 1)
	(1)	(2)
Andhra Pradesh	.937	34.0
Assam	.847	38.3
Bihar	--	--
Gujarat	.932	38.3
Haryana	.913	39.9
Karnataka	.871	33.2
Kerala	.944	27.6
Madhya Pradesh	.950	39.8
Maharashtra	.886	30.6
Orissa	.896	36.2
Punjab	.947	30.9
Rajasthan	.954	36.9
Tamil Nadu	.874	32.2
Uttar Pradesh	.984	40.2
West Bengal	--	--
All-India	.922[a]	36.0[b]

[a]Ratio, SRS all-India birth rates 1970-73 without Bihar and West Bengal to estimated all-India rate for 1971-72.
[b]Ratio, SRS birth rates, all-India except Bihar and West Bengal, to column 1.

in Uttar Pradesh. There seems to be no correlation between state-specific incompleteness estimates for birth rates and those for death rates previously shown; however, we have already concluded that there is no firm basis for inferring interstate differences in death registration completeness.

Unfortunately, we have no independent source with which to evaluate the completeness of SRS birth rates later in the decade. Let us assume constancy of underregistration and suppose that the state-specific completeness estimates of Table 31 were applied to SRS crude birth rates in 1979. The old sample areas should be used since they are the ones for which completeness was estimated. Results in Table 31 represent the latest period for which birth rates can be estimated in this report. The ultimate check on the assumption of constant underregistration is the intercensal growth rate, which is incorporated in Chapter 4.

NOTES

1. Effective duration of marriage was determined by relating reported age at first cohabitation to reported current age in the case of married women, regardless of how many times married, and to reported age at termination of marriage in the case of widowed, divorced, or separated women.
2. In particular, the state values of children ever born and children surviving per mother by age as given in India, Registrar General (1976b) for rural and urban areas were weighted by the number of ever-married women by age in urban and rural areas (India, Registrar General, 1977a). The only areas that could not be included in this calculation because of the absence of fertility/mortality data were Sikkim and Nagaland, which constitute about .001 of the total population.
3. In particular, the logit of p(x) is subtracted from the logit of p(x) in the South model life table of level 11; the average logit difference from the standard is then used to derive the graduate q(2) values. In doing this we have ignored the estimates of q(1), as it is typically biased upward due to age of mother and birth-order differences in child mortality. The estimate of q(10) was also ignored

in order to keep the effect of recall lapse to a minimum.

4. In the investigations of couple fertility of the NSS, stillborn babies were included in the calculation of children ever born to a woman. The analysis presented here, however, is based on the information collected in the 12th schedule of the NSS, which does not include stillborn babies.
5. During the period 1961-70, net national product at constant prices increased at an annual rate of 3.3 percent and gross value of output from agriculture at 2.5 percent (India, Central Statistical Organisation, 1975a, 1975b), while the population increased at a rate of 2.2 percent.
6. In the 16th round of the NSS, CEB/CS data were tabulated by age categories of 17-21, 22-26, etc. Regression coefficients used in converting this information into q(x) values, developed by P. N. Mari Bhat, appear in Appendix B.
7. The all-India data of the 1965-66 NSS indicate that child mortality among Hindus is slightly higher than that of the total population--the graduated value of q(2) for Hindus is 0.231, and for the total population it is 0.225. The corresponding values for Muslims and Christians are 0.206 and 0.156, respectively. Relatively low child mortality among Christians may be at least partly due to the fact that they reside in relatively low mortality areas, such as Kerala and Assam.
8. To some extent the implied increase in child mortality is also the result of graduation. An example may help in clarifying this: for q(10) value of 0.197, q(2) value in the South model life tables (both sexes) is 0.154; but the logit transformation using South model level 11 (both sexes) as the standard yields an estimate of q(2) of 0.143.
9. The "level" of mortality implied by the ${}_5M_0$ values of the SRS is identified by comparing it with the ${}_5M_0$ values in South model stable populations (both sexes) with a growth rate of 0.020 and varying "levels" of mortality. The q(2) value in the South model life table (both sexes) corresponding to the identified "level" is taken as the requisite estimate.
10. The estimated reference dates of the graduated q(2) values of all-India are also roughly applicable to the state-specific estimates. The differences among

states in age-specific parity distributions are too small to have a significant impact on the estimates of the time references of the q(x) values.

11. Life expectancy at age 70 was computed on the basis of age-specific growth rates and death rates, in the age interval 70+ by the procedure recommended by Horiuchi and Coale (1982). The mean age at death for persons dying below age 1 was taken to be .25 years and for persons dying between 1 and 5, 2.25 years.

12. The Brass and Preston-Coale procedures were applied to state-specific SRS data for 1970-71, 1972-74, and 1975-76, supplied to the panel for this purpose by the Registrar General. The Brass procedure was tried for the age ranges 5-50 and 20-60; results from the two ranges for females were similar in level and regional pattern, but for males the 5-50 range seemed to give quite erratic results, perhaps because of net interstate migration. The Preston-Coale results were computed based on three different assumed growth rates, each of which was an output of the Brass procedure applied to ages 5-50 but with 0, 1, and 2 ages trimmed. Preston-Coale completeness was estimated for each growth rate and for each starting age ranging from 0-65. The growth rate producing the smallest mean absolute deviation from age to age was adopted, together with its associated mean completeness estimate.

13. For birth rate estimates, it is clearly necessary to use the death rate at all ages combined. For this reason, growth rate and completeness estimates should refer to ages 0+. The growth rate used for each state was that derived from the Brass procedure fit to ages 5-50, without trimming. Using this age span employs the maximum amount of information on the population aged 0-4. The implied value of r was then substituted into the Preston-Coale procedure, and the completeness estimate for age 0+ was adopted. It should be noted that there was relatively little variation in completeness estimated by Preston-Coale according to the initital age chosen.

14. The ever-married distribution from the 1972 Fertility Survey was not directly available. The currently married distribution from the survey was derived by dividing age-specific fertility rates by age-specific marital fertility rates, except at ages 45-49, for which the process yielded a proportion married

greater than unity. A value of unity was thus substituted. To the proportion currently married was added the census proportion widowed and divorced by age. Although this age schedule was not directly available from the survey, the total proportion widowed/divorced/separated above age 10 was available and it corresponded very closely to the 1971 census proportion widowed/divorced/separated (see note 15).

15. For population over age 10, the following marital status distributions were recorded in census and survey:

	1971 Census		1972 Fertility Survey	
	Rural	Urban	Rural	Urban
Single	.207	.292	.249	.330
Married	.657	.590	.619	.556
Others	.136	.118	.133	.114

16. The procedure is the following. Mean parity in 1972 by cohort was increased by the rate in the three age intervals at which the cohort bore children during the 6.5 years between 1972 (July 1) and 1979 (January 1). Using lexis diagram reasoning and recognizing that the age-specific fertility rates reported for ages x to x + 5 in fact refer to ages x - 0.5 to x + 4.5, a cohort will spend 2.025 years between the surveys bearing children at the rate for the interval in which it started, 4.075 years at the rate of the next interval (x + 5 to x + 10), and 0.4 years at the rate of the interval x + 10 to x + 15. Age-specific fertility rates are assumed to be constant within five-year intervals. By 1979, the cohort aged x to x + 5 in 1972 was aged x + 6.5 to x + 11.5. The cumulative parity in 1979 for age x to x + 5 was derived as

$$\frac{3.5}{5}\,{}_5P_x + 1.5 + \frac{1.5}{5}\,{}_5P_x - 3.5.$$

17. For some cases, the proportion currently married from the survey, together with the proportion widowed, divorced, or separated from the census, implied an ever-married proportion of greater than unity. In such instances we have accepted the census ever-married proportion; the fertility rate of the age interval was adjusted such that the sum of fertility and marital fertility rates of the interval produced the recorded sum. The rural parity value for Rajasthan of 5.46 at ages 30-34 was changed to 4.46, giving among other things a reasonable proportion dead and age progression of parity; at ages 20-24 in Gujarat the values for children ever born and children surviving of 1.53 and 1.81 were assumed to have been transposed.
18. It is not clear whether results for West Bengal are included in all-India values in the published report of the survey. Parity values for West Bengal are presented, but current fertility values are not, although the information was gathered (India, Registrar General, 1976b:70-73).

3 CENSUS-BASED ESTIMATES

3.1 DECADE OF 1961-71

Intercensal analysis is a venerable and still very useful means of obtaining demographic estimates for India and its states. In this chapter we concentrate on the intercensal period from 1961 to 1971. The method we employ to make intercensal estimates for the 1961-71 decade is essentially a modification of the intercensal survival technique originally suggested by Coale and Demeny (1967). The first step is the production of intercensal life tables from the indications of survivorship between two censuses. This aspect requires projecting the age distribution from the first census forward by 10 years using survival rates implied by model life tables covering a wide range of mortality levels. Comparison of the cumulated projected populations above given ages at the second census (e.g., 10+, 15+, etc.) with the cumulated populations actually enumerated above those ages gives a series of estimates of the level of mortality of the nonchild (mainly adult) population corresponding to a series of open-ended survivorship ratios. Cumulated populations are compared because of the dampening effect that cumulation has on age-misreporting. Therefore, unlike the method employed by the Registrar General to compute the official life tables, this technique does not involve prior smoothing of census age distributions. The resulting mortality estimates are often expressed in terms of a series of values of life expectancy from age 5 (e_5), and a composite estimate of nonchild mortality is usually selected with reference to the first nine age-specific values of implied e_5.

It has been shown that, ceteris paribus, estimates of e_5 derived by this procedure vary little, regardless of

the model life table pattern employed (Coale and Demeny, 1967:12). However, the relationship between child mortality and mortality above age five varies considerably between model life tables. Therefore, without additional information on the nature of this relationship, one cannot confidently extrapolate from the e_5 estimate to obtain an estimate of child mortality (and thus an estimate of life expectancy from birth). But in the case of India we do have independent estimates of the level of child mortality, presented in Chapter 2. In order for the life tables derived from censal survival analysis to incorporate these child mortality estimates, we took advantage of the two-parameter logit life table system developed by Brass (1975). This system was used to combine estimates of child mortality with estimates of nonchild mortality derived from the census survival analysis. Specifically, the value of child mortality as gauged by survivorship to age two (l_2) was fixed at levels shown in Table 17. Then, using a South model life table (level 11) as standard, β--the slope parameter in the logit life table system--was systematically varied to generate a set of life tables embodying a wide range of relationships between adult mortality and the stipulated level of child mortality as indicated by the fixed level of l_2.[1] These life tables were then used to project the age distribution of the first census. Comparison of the projected to the enumerated populations above given ages identified for each age the best-fitting value of β and the corresponding values of e_5. The South model life table system was chosen because it provided the best representation of relationships between child and adult mortality in the SRS data.

Construction of life tables by sex necessitated a state-by-state examination of sex differentials in child mortality. Table 32 presents such differentials (m-f) in mortality to age two (q_2) implied by the Sample Registration System's infant mortality rates for 1968-70 as well as those contained in the child mortality data from the 1972 Fertility Survey. Note that, for most states, both sources concur on the direction and approximate magnitude of the sex differential. Note, too, the indication that survivorship is lower among males than among females in all the southern states, while the reverse is generally true in the north. This regional clustering bolsters one's confidence in the results. To obtain sex-specific values of l_2 for the construction of life tables, the mean sex differentials in mortality (column 3) were applied to the mid-decade q(2) values from Table 17 of Chapter 2, and the complements give sex-specific

TABLE 32 The Derivation of Sex-Specific l_2 Values for the 1961-71 Intercensal Analysis: Selected States and All-India

State	S.R.S.[a] Δq_2 * 1000 m-f	Fertility Survey[b] Δq_2 * 1000 m-f	Mean Δq_2 * 1000 (1)+(2)/2.0	q_2 Both Sexes Combined[c]	Sex-Specific Values of Survivorship to Age 2 (l_2)	
					Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	+22	+15	+18.5	.176	.8148	.8333
Assam	+26	+23	+24.5	.157	.8308	.8553
Bihar	-12	-11	-11.5	.190	.8158	.8043
Gujarat	-6	-4	-5.0	.166	.8365	.8315
Haryana	-12	-9	-10.5	.163	.8423	.8318
Karnataka	+12	+10	+11.0	.155	.8395	.8505
Kerala	+14	+10	+12.0	.099	.8950	.9070
Madhya Pradesh	-4	0	-2.0	.197	.8040	.8020
Maharashtra	-2	-4	-3.0	.153	.8485	.8455
Orissa	+12	+5	+8.5	.202	.7938	.8023
Punjab	-18	-20	-19.0	.138	.8715	.8525
Rajasthan	-10	-10	-10.0	.186	.8190	.8090
Tamil Nadu	+20	+24	+22.0	.180	.8090	.8310
Uttar Pradesh	-24	-5	-14.5	.262	.7453	.7308
West Bengal	+2	-3	-0.5	.141	.8593	.8588
All-India	-2	+2	0	.184	.8160	.8160

[a]Based on mean sex-specific SRS q(1) values for 1968-70, transformed to q(2) (principal source: Dyson, 1979b).
[b]Three sex differentials in graduated values of q(2) are those implied by the sex-specific q(x) values found in Natarajan (1980).
[c]Source: column 3 of Table 17.

values of l_2 (columns 5 and 6). For all-India this procedure produces identical early age survivorship among males and females.

Intercensal survival analysis requires that the age distributions for both censuses refer to the same geographical area and that adjustments are made for intercensal interstate migration. The age distributions for five states--Assam, Bihar, Uttar Pradesh, Punjab, and Haryana--needed adjusting for intercensal changes in state boundaries. These adjustments were minimal with regard to the first three states but quite substantial in the case of the last two. In particular, large parts of what was formerly the Punjab were transferred during the 1961-71 intercensal period to form the new state of Haryana and the Union Territory of Chandigarh. Additional areas of Punjab were transferred to Himachal Pradesh. It did prove possible to make satisfactory allowance for these changes in all cases.

State-specific total net intercensal migration estimates by sex derived from a census question on duration of residence are given in Table 33. Age-specific data on respondents giving their duration of residence as 0-9 years were used to make some allowance for net intercensal migration. It is worth noting that according to this data females are generally less mobile than males. The population of the country as a whole during the 1961-71 decade can effectively be considered closed.

A summary of the results of applying the intercensal survival technique to the data for all-India is presented in Table 34. Given that the values of survivorship to age two (l_2) have been fixed, variation in the estimates of implied life expectancy at birth (e_0) as the age range of estimation varies is explained almost totally by variation in implied nonchild mortality. This variation is also reflected in the progression of β. The sequence of β values is, naturally enough, consistent with the characteristics of age-misstatement in India. The e_0 figures range from 42.0 to 51.1 years for males and 41.2 to 48.8 years for females. The implied low survivorship (high β) at 15+/5+ and high survivorship (low β) at 25+/15+ are consistent with a substantial deficit of persons recorded as ages 15-19 in both censuses. When these two estimates are eliminated from the series, the range of implied e_0 is very substantially reduced. Table 34 shows that similar estimates result whether one accepts the mean or median β values, although the exact choice is inevitably arbitrary.

If we accept the parameters stemming from the mean values of β, then life expectancy at birth (e_0) is estimated at 46.8 years for males and 45.3 years for females. Since the l_2 values for the two sexes are identical (see Table 32), the difference in e_0 relates to nonchild mortality and results from the implications of differential census survivorship between the two sexes. Indeed, the estimated value of life expectancy from age five (e_5) for males is 1.7 years greater than that for females.

The estimates of life expectancy at birth presented here for all-India are not very different from those contained in the official life tables of India, 1961-71, which are also based on intercensal cohort comparisons but with graduation procedures substituting for the use of model life tables. The official tables contain a life expectancy at birth of 46.4 for males and 44.7 for females (India, Registrar General, 1977b). However, the e_0 in the official tables is obtained with a very different combination of child and adult mortality than that suggested here. In the official tables e_5 is 52.0 (males) and 50.2 (females), compared with estimates here of 55.6 and 54.0. This discrepancy seems to result mainly from a decision made in producing the official tables to reduce the enumerated population of adults in 1971 so that the total population of each sex was unchanged when the number of children in 1971 was inflated to account for results of a special postenumeration inquiry. This reduction created the appearance of fewer intercensal survivors and hence of higher adult mortality between censuses (Dyson, 1979a). It appears that e_5 in the official tables is too low. At the same time, the official tables used an estimate of intercensal mortality below 5 that was considerably lower than that recorded by SRS at the end of the decade (Dyson, 1979a). But the new information uncovered on child mortality in Chapter 2 provides strong indication that intercensal child mortality was higher even than that contained in the end-decade SRS. So the official life tables appear to contain two large differences that are offsetting in their effects on e_0. They are not offsetting, however, in their effects on mortality parameters at other ages or on fertility estimates based on intercensal experience.

The same technique was applied to data for states, using the state- and sex-specific level of q(2) in the construction of a series of β-varying South model life tables. Once again, values corresponding to the mean of

the first 9 β values were adopted. The state-level estimates are summarized in Table 35. For males, the e_5 estimates fall mainly in the age range 54-58. According to these figures three states in particular--Kerala, Punjab, and Haryana--have comparatively low levels of nonchild mortality. It is interesting to recall that these states (especially the first two) also appear to have relatively low levels of infant and child mortality. The combined effect is to produce estimated intercensal values of life expectancy at birth of 57.7, 55.4, and 52.0 years, respectively. The value of e_5 for West Bengal of 51.0 years is particularly low, and the β value for this state, 1.40, is implausibly high.

Table 35 also presents the estimated life table parameters for females. The estimated values of e_5 for females are more variable than those for males. Again, Kerala and Punjab appear to have comparatively favorable levels of female nonchild mortality. The lowest e_5 value is for Uttar Pradesh, and, combined with the assumed levels of child mortality, it results in an estimate of life expectancy at birth of only 37.3 years.

The analysis was also conducted with age distributions that were not adjusted for migration in order to assess the impact that such adjustment has on the estimated values of nonchild mortality. The mean absolute difference in e_5 estimates between the two series, adjusted and unadjusted for migration, was 0.7 years for females and 1.1 years for males, the more migratory sex. It is quite possible, however, that some of the estimates in Table 33 as to both the magnitude and the direction of intercensal migration are misleading. The β values for West Bengal and Karnataka are particularly high. Assuming that the levels of child mortality estimated for these states are of the right order of magnitude, they are indicated to have unusually heavy adult mortality, which may result from an overestimate of net in-migration.

The production of intercensal life tables allows the estimation of crude birth and death rates by the procedures of reverse and forward survival. The estimated state-level life tables were used to back-project the unadusted age group 0-9 enumerated in 1971 to give an estimate of the intercensal crude birth rate (reverse survival). The 0-9 age group was employed to help minimize errors due to omissions and age-misreporting among young children. Subtraction of the average annual intercensal rate of growth from this birth rate gives an estimate of the death rate for the decade. Forward

TABLE 33 Estimates of Net Intercensal Migration, by Sex and for the 1951-61 and 1961-71 Intercensal Decades; Total Numbers and Rates: Selected States and All-India

State	1951-61[a]				1961-71[b]			
	Total (1,000s)		Average Annual Rate (per 1,000)		Total (1,000s)		Average Annual Rate (per 1,000)	
	Male	Female	Male	Female	Male	Female	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	-121	-73	-9.72	-0.44	-50	-32	-0.25	-0.16
Assam	+545	+312	+10.54	+6.91	+79	+22	+1.14	+0.36
Bihar	-443	-71	-2.08	-0.33	-322	-116	-1.23	-0.46
Gujarat	+77	-6	+0.81	-0.07	+54	+14	+0.44	+0.12
Haryana	--	--	--	--	+27	+31	+0.57	+0.76
Karnataka[c]	+153	+100	+1.40	+0.95	+36	+10	+0.27	+0.08
Kerala	-218	-82	-2.90	-1.06	-152	-85	-1.60	-0.88
Madhya Pradesh	+311	+207	+2.08	+1.45	+158	+129	+0.83	+0.72
Maharashtra	+583	+260	+3.16	+1.50	+461	+220	+1.98	+1.01
Orissa	-74	-76	-0.92	-0.94	+57	+72	+0.58	+0.73
Punjab	--	--	--	--	-79	-78	-1.19	-1.37
Rajasthan	-211	-85	-1.28	-0.99	-159	-111	-1.32	-0.92
Tamil Nadu[d]	-213	-154	-1.33	-0.97	-69	-58	-0.37	-0.31

Uttar Pradesh	-829	-187	-2.31	-0.57	-715	-327	-1.67	-0.86
West Bengal	+1,637	+962	+10.01	+6.75	+220	+15	+1.05	+0.08
Composite Punjab[e]	-144	-84	-1.60	-1.08	--	--	--	--
All-India	+1,756	1,340	-0.86	-0.69	--	--	--	--

[a]Computed from 1961 census data on duration of residence 0.9 years plus the estimates of net international migration contained in Zachariah and Seetharem (1968:47-63). The estimates of international migration are very rough, yet they form a very substantial component of the net (1951-61) interstate migration estimates for adjoining eastern states of Assam, Bihar, and West Bengal.

[b]Computed from 1971 census data on duration of resident 0-9 years kindly supplied by the Registrar General of India.

[c]Known during the 1951-61 decade as Mysore.

[d]Known during the 1951-61 decade as Madras.

[e]The erstwhile Punjab of 1961, consisting essentially of what are now Punjab and Haryana.

TABLE 34 Estimates of α, β, e_0, and e_5, Corresponding to Proportions Surviving to Age x and Over in 1971, from Age x-10 and Over in 1961, Males and Females: All-India

Age at Second Census (x)	Male				Female			
	α	β	e_0	e_5	α	β	e_0	e_5
	(1)	(2)	(3)		(4)	(5)	(6)	(7)
10	-.0920	1.0230	47.24	55.95	+.0232	1.2035	43.72	51.98
15	+.0828	1.2969	42.04	50.09	+.1129	1.3440	41.24	49.18
20	-.0898	1.0264	47.17	55.87	-.1203	.9786	48.17	56.99
25	-.2054	.8452	51.14	60.35	-.1403	.9472	48.84	57.76
30	-.1174	.9831	48.08	56.89	+.0046	1.1743	44.26	52.59
35	-.0747	1.0501	46.68	55.32	+.0107	1.1838	44.08	52.39
40	-.0764	1.0475	46.74	55.38	-.0297	1.1207	45.28	53.75
45	-.0642	1.0664	46.35	54.95	-.0490	1.0903	45.88	54.42
50	-.0604	1.0725	46.23	54.82	-.0688	1.0593	46.49	55.11
Based on Mean of β	-.0775	1.0457	46.77	55.42	-.0285	1.1224	45.25	53.71
Based on Median of β	-.0764	1.0475	46.74	55.39	-.0297	1.1207	45.28	53.75

Note: For the standard life table South level 11 see Note 4 to the text. Alpha (α) is the level parameter in the two-parameter life table system (see Note 4).

TABLE 35 Estimated Life Table Parameters (α, β, e_0, and e_5), by Sex and State: Selected States and All-India

State	Male				Female			
	α	β	e_5	e_0	α	β	e_5	e_0
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Andhra Pradesh	-.0224	1.1257	53.56	45.05	-.0345	1.2069	52.96	45.65
Assam	-.0908	1.1046	54.99	47.32	-.1355	1.1799	55.00	48.91
Bihar	-.0980	1.0125	56.18	47.43	+.0824	1.2367	50.64	41.84
Gujarat	-.1107	1.1057	55.32	47.99	-.1622	.9966	57.49	49.62
Haryana	-.2318	.9496	59.30	51.98	-.1061	1.0862	55.46	47.81
Karnataka	-.0805	1.1703	54.13	47.09	-.0757	1.2436	53.36	47.08
Kerala	-.4157	1.0276	61.50	57.73	-.4188	1.1283	60.46	57.61
Madhya Pradesh	-.0338	1.0531	54.58	45.27	-.0308	1.0479	54.59	45.12
Maharashtra	-.1425	1.1266	55.66	49.07	-.1633	1.0760	56.57	49.71
Orissa	+.0258	1.0966	53.05	43.32	.0491	1.1745	51.81	42.75
Punjab	-.3370	.9718	60.83	55.42	-.2532	.9779	59.31	52.68
Rajasthan	-.0794	1.0584	55.31	46.86	-.0944	.9831	56.49	47.27
Tamil Nadu	-.1059	.9652	56.92	47.65	-.0639	1.1479	54.06	46.50
Uttar Pradesh	+.0302	.8886	55.72	42.63	+.1991	1.0945	50.16	37.26
West Bengal	-.0134	1.3969	51.02	45.48	-.0863	1.2794	53.24	47.50
All-India	-.0775	1.0457	55.42	46.77	-.0285	1.1224	53.71	45.25

survival consists of applying the state-level life tables to the estimated mid-decade state populations to obtain an estimate of the average decadal crude death rate; summing this death rate and the average annual intercensal rate of growth gives an estimate of the birth rate for the period.

Table 36 presents the resulting estimates of birth rates. Columns 2 and 3 contain the estimates obtained by using the unadjusted state age distributions. Column 4 contains crude birth rates calculated using the state-level life tables and the Registrar General's adjusted 0-4 age groups (India, Registrar General, 1977c). Columns 5 and 6 present total fertility rates calculated by indirect standardization corresponding to the crude birth rates in columns 1 and 2.[3]

It should be stressed that the two sets of estimates in columns 2 and 3 are not completely independent. For example, if the levels of child mortality incorporated in the life tables are indeed too low, then the resulting estimated crude birth rates by both reverse and forward survival will also be too low. Omitting the 0-9 age group differentially from the census could have a similar effect. Nevertheless, the degree of correspondence between the estimates of the crude birth rates is encouraging; the correlation coefficient of the figures in columns 1 and 2 is quite high ($r = 0.96$). It is also of interest to note that the reverse survival birth rates based on the unadjusted 0-9 age group are not systematically lower than those derived using the Registrar General's adjusted age distribution at ages 0-4.

Table 37 presents the corresponding estimates of the crude death rate. Again, agreement between the two sets of figures is close.

A related procedure to that described above adopts the life table produced by the SRS as the "model" for intercensal analysis. Comparison of the 1971 population to that projected for 1971 by applying the SRS life table to the 1961 age distribution provides a test of consistency of the SRS data with intercensal survival experience. Results of this procedure, using an SRS-based life table for 1969-71, are shown in Table 38.[4]

For males there appears to be a high degree of consistency between intercensal survival experience and adult mortality experience recorded in the SRS at the end of the decade. The ratio of actual to projected population begins to rise after ages 40-44 at the second census, slowly at first and then quite rapidly. Presumably this

TABLE 36 Intercensal Crude Birth Rates and Total Fertility Rates, 1961-71, Estimated Using the State-Level Life Tables and Procedures of Reverse and Forward Survival: Selected States and All-India

State	Reverse Survival Based on Unadjusted Number of Children 0-9	Forward Survival	CBR, 1966-71 Reverse Survival Based on Adjusted Children 0-4	Total Fertility Rates by Indirect Standardization	
				Reverse	Forward
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	39.0	37.9	40.1	5.08	4.94
Assam	47.3	46.0	44.0	6.94	6.76
Bihar	42.4	39.6	42.0	5.81	5.42
Gujarat	41.3	41.6	39.2	5.81	5.85
Haryana	44.3	43.7	44.4	6.95	6.87
Karnataka	39.7	39.0	36.4	5.55	5.46
Kerala	33.8	35.8	34.5	4.57	4.83
Madhya Pradesh	46.0	44.1	46.7	6.53	6.26
Maharashtra	39.6	38.8	39.8	5.34	5.24
Orissa	42.5	42.1	39.8	5.74	5.70
Punjab	35.4	34.8	35.5	5.56	5.47
Rajasthan	44.3	43.4	43.8	6.39	6.28
Tamil Nadu	36.2	37.4	37.5	4.58	4.74
Uttar Pradesh	45.1	43.0	44.7	6.60	6.29
West Bengal	40.4	40.7	40.7	5.90	5.96
All-India	41.3	40.6	41.2	5.77	5.67

TABLE 37 Crude Death Rates, 1961-71, Estimated Using the State-Level Life Tables and the Procedures of Reverse and Forward Survival: Selected States and All-India

State	Crude Death Rates	
	Reverse[a]	Forward[b]
(1)	(2)	(3)
Andhra Pradesh	19.9	18.7
Assam	18.0	16.7
Bihar	22.3	19.5
Gujarat	15.8	16.1
Haryana	16.9	16.3
Karnataka	18.1	17.4
Kerala	9.4	11.3
Madhya Pradesh	21.5	19.6
Maharashtra	16.6	15.9
Orissa	20.6	20.3
Punjab	14.5	13.9
Rajasthan	18.6	17.8
Tamil Nadu	15.8	17.0
Uttar Pradesh	26.0	23.8
West Bengal	17.1	17.4
All-India	19.1	18.4

[a]Corresponds to column 2 of Table 36.
[b]Corresponds to column 3 of Table 36.

pattern reflects persistent age overstatement at the higher ages. The mean ratio for the first eight ages (i.e., for all those below 50 at the second census) for males is 1.005. For the first six ages, the mean ratio is 1.000. Thus, there is little reason for concern about inconsistencies between intercensal survival experience for males and mortality levels recorded in the SRS.

For females, however, the comparison is less satisfactory, as shown in Table 38. The mean of the first eight ratios of actual to expected population for females is .976 and of the first six it is also .976. The two most likely explanations of the inconsistency revealed by these figures are that the SRS has recorded too low a level of mortality for women or that a higher fraction of females was omitted from the 1971 than from the 1961 census. The indirect estimates of death registration completeness described in Chapter 2 suggest that, in fact, female deaths were less completely recorded than male deaths by some 6 percent in the SRS. The abrupt increase in sex ratios (M/F) in the 1971 census, followed by a decline between 1971 and 1981, suggests that females were in fact differentially omitted in the 1971 census. It will also be recalled from Chapter 1 that the 1971 Post Enumeration Check discovered higher female than male net omission from the 1971 census. It was estimated that 1.53 percent of males and 1.83 percent of females were omitted; however, the age patterns of omission were also different. Of the omitted females, 16.7 percent were over age 45, versus only 9.8 percent of males. The female omission rate rises with age from 0.84 percent at ages 35-44 to 1.46 percent at ages 45-59 and 2.35 at age 60+. This pattern, even if it were constant over censuses, would imply poorer adult survival from intercensal comparison than actually prevailed. The estimated omission rate for males actually declined with age from 1.04 percent at ages 35-44 to 0.81 percent and 0.77 percent at the two higher age groups. One possible reason for the higher female underenumeration with age is differential omission of single-person households.

We believe that some combination of the two explanations--female death omission from the SRS and female omission from the 1971 census--is probably operative, but available data and procedures make choosing the exact combination an act of specualtion.[5] The final column in Table 38 shows what the ratios of actual to projected population would be if SRS female deaths by age were inflated by 10 percent and if the 1971 count of females by age were raised by the factor 1.008, thereby placing the sex ratio in 1971 about halfway between those in 1961 and 1981.[6] This combination of corrections raises the mean of the first six ratios to .995 and of the first eight to .997. It also produces an age sequence of ratios that is quite similar in general configuration to the male sequence shown in Table 38. The latter consideration is

TABLE 38 Intercensal Survival Analysis Using SRS Death Rates 1969-71 to Project Forward the 1961 Population to 1971: All-India

Age in 1961	1961 Census Population (in 1,000)	Estimated SRS 10-Year Survival Rates	1961 Population Survived Forward	Population in Column 3 Cumulated from Bottom	1971 Census Population Cumulated	Ratio, Actual to Projected	Ratio, Actual to Projected if Death Rates Inflated by 10% 1971 Census Count, Inflated by 1.008
	(1)	(2)	(3)=(1)x(2)	(4)	(5)	(6)=(5)/(4)	(7)
Males							
0-4	33,201	0.85214	28,292	200,965	201,618	1.003	--
5-9	33,088	0.97147	32.144	172,672	165,117	0.956	--
10-14	26,286	0.97607	25,657	140,529	139,890	0.995	--
15-19	18,606	0.97164	18,078	114,872	118,312	1.030	--
20-24	18,206	0.96696	17,604	96,794	97,969	1.012	--
25-29	18,540	0.96009	17,800	79,189	79,644	1.006	--
30-34	15,994	0.94580	15,127	61,389	62,404	1.016	--
35-39	13,609	0.92132	12,538	46,261	47,343	1.023	--
40-44	12,091	0.88336	10,681	33,723	34,873	1.034	--
45-49	9,740	0.83137	8,098	23,042	23,755	1.031	--
50-54	9.135	0.75919	6,935	14,945	16,877	1.129	--
55-59	5,286	0.66646	3,523	8,010	9,391	1.172	--
60-64	5,709	0.51221	2,924	4,487	5,746	1.281	--
65-69	2,474	0.36406	901	1,563			
70+	4,179	0.15840	662	662			

Females

0-4	32,928	0.83389	27,458	188,504	184,942	0.981	1.000
5-9	31,612	0.96546	30,520	161,046	152,660	0,948	.965
10-14	23,040	0.96418	22,214	130,525	130,409	0.999	1.017
15-19	17,290	0.95595	16,528	108,311	108,876	1.005	1.025
20-24	19,141	0.95201	18,222	91,783	88,390	0.963	.983
25-29	18,056	0.94781	17,114	73,560	70,519	0.959	.981
30-34	14,860	0.94275	14,009	56,446	54,853	0.972	.996
35-39	11,865	0.93286	11,068	42,437	41,620	0.981	1.009
40-44	10,779	0.90744	9,781	31,369	31,200	0.995	1.028
45-49	8,327	0.86840	7,231	21,588	21,783	1.009	1.049
50-54	7,983	0.80582	6,433	14,356	15,830	1.103	1.156
55-59	4,551	0.71541	3,256	7,924	8,939	1.128	1.199
60-64	5,535	0.55213	3,056	4,668	5,581	1.196	1.284
65-69	2,380	0.38778	993	1,612			
70+	4,445	0.15495	689	689			

not immaterial in determining the combination of death/census omission since adopting a higher assumed level of death omission and lower level of census omission raises the actual/expected ratios at older ages and lowers them at younger ages. That the female sequence in the final column of Table 38 is brought into close alignment with the male is thus evidence, albeit weak, that a satisfactory combination of female omissions has been found.

If the 1971 census count of females should be raised by 0.8 percent to make it comparable in completeness to the 1961 census, then our earlier intercensal survival analysis has somewhat overestimated the level of female mortality during 1961-71. However, the adjustment is neither sufficiently large (less than 1 year of life expectancy at birth or age 5) nor sufficiently well justified to cause a recasting of earlier results. Note that a revision would not affect the estimated intercensal birth rate. Adding 0.8 percent to the 1971 census population would increase the average annual female intercensal growth rate by .0008 and reduce the female intercensal death rate by a like amount.

3.2 DECADE OF 1971-81

As noted above, the 1981 age distribution from a 5-percent sample of the total population became available as this volume was going to press (India, Registrar General, 1983c). Due to its significance as an independent check on the SRS based estimates, we performed an intercensal survival analysis for all-India (exclusive of Assam which was not included in the 1981 census owing to disturbed conditions).

We employed two methods recently developed as offshoots of the generalization of stable population relations. The first is a method, due to Preston and Bennett (1983), for estimating adult mortality that makes use of a simple relationship existing in any closed population between the ratio of populations at two ages at any moment, the probability of survival between those ages, and the growth rates between those ages. The advantage of the method is that the only data needed are age distributions from two censuses, and it requires neither the assumption of stability nor the adoption of an age pattern of mortality from a model life table system. The second method, the integrated procedure developed by Preston (1983) that builds on the Brass logit life table system (Brass, 1975)

and generalized stable population equations, amalgamates an independently derived estimate of child mortality with the age distributions from two successive censuses in arriving at an estimated birth rate and level of mortality. The birth rate in this method in inferred from the intercept of a line fitted to data points, while the slope determines the level of adult mortality.

Since the age-sex distributions were not available, the above analysis could not be carried out by sex. Though not required under the methods, we treat India's population as essentially closed to migration. There were, however, speculations about large-scale immigration into the country during 1971-81 (e.g., Mukerji, 1982). If it took place, such migration went largely undisclosed in the census since the reported number of foreign-born persons in the country, exclusive of Assam, declined from 8.121 million in 1971 to 7.938 million in 1981 (India, Registrar General, 1983c).

In Figure 6 we plotted the ratios of the estimates of life expectancy for ages 5-55 derived from the application of the Preston-Bennett procedure to the corresponding values in the West model life table of level 15. For ready comparison, also presented are the ratios obtained by application of the procedure to the 1961-71 and 1951-61 intercensal periods. The variations in the level of mortality implied by the life expectancy values at various ages are remarkably similar in the three intercensal periods; they undoubtedly arise from the idiosyncrasies in age misreporting in India. But the figure also seems to establish the fact that, over time, life expectancy rose almost uniformly at every age. Between 1961-71 and 1971-81, the proportionate increases in the life expectancy at ages 5-55 fall in the range of 9-13 percent, and between the preceding two intercensal periods they lie in the neighborhood of 12-18 percent. Given the quality of the data, these are surprisingly narrow intervals of variation. The mean of the ratios shown in Figure 4 for the 1971-81 period is 1.047, implying a life expectancy at age 5 (e_5) of 60.2 years, while the corresponding estimate for 1961-71 is 54.1 (compared with 54.8 years estimated from the forward projection method in Section 3.1) and 46.9 years for 1951-61. Thus, the fears about a premature slowing down of mortality transition in India are not supported by intercensal analysis.

In applying the integrated method, we experimented with two standard life tables and three values of child mortality. The standards chosen are the South model life

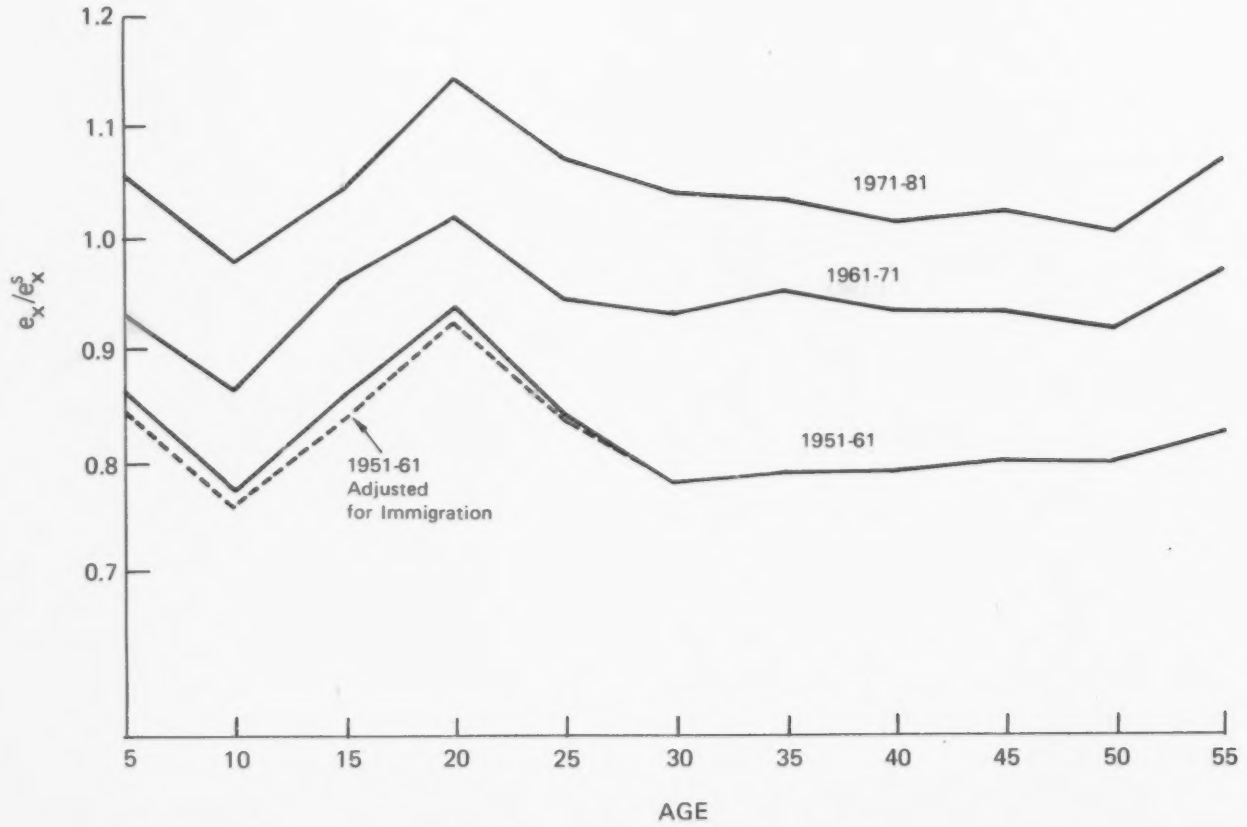


FIGURE 6 Ratios of Estimates of Life Expectancy at Various Ages to Corresponding Values in West Model Life Table, Level 15

table of level 15 and a life table with an e_0 value of 50 belonging to South Asian family of the new U.N. model life table system (United Nations, 1982). The South Asian model, constructed with SRS tables as a main ingredient, show extremely low mortality in the age range 10-50 and unusually high values outside this range. Among the Coale-Demeny tables, life tables belonging to the South family show similar, but smaller, deviations.

As discussed in Chapter 2, there was poor agreement between the 1979 survey estimates of child mortality and those based directly on the SRS. Hence, in applying the method, we tried three values of p(5), the probability of surviving to age 5. They correspond to the graduated q(2) of 0.125 from the 1979 survey, the raw q(2) of 0.143 from the same survey, and a death rate under age 5 of 51.0 per 1,000 from the SRS for 1976. These were converted into p(5) values via the South model life table system. The estimates of various demographic parameters resulting from the above combinations are given below. In all cases, estimates were derived by fitting a line to data points for ages 5-30 and 35-55, using the grouped mean procedure:

Standard Life Table	p(5)	BR	DR	e_0	e_5
South, Level 15	.854	34.3	12.1	56.9	61.5
	.830	35.3	13.1	55.4	61.5
	.788	37.2	15.0	52.6	61.5
South Asia, $e_0 = 50$	.854	34.3	12.1	55.5	59.8
	.830	35.4	13.2	54.0	59.8
	.788	37.3	15.1	51.3	59.8

As would have been expected, the choice of the standard life table did not affect the estimated birth rate, while that of adult mortality was somewhat sensitive to the choice. Even so, the estimates of e_5 show a narrow range of variation (59.8-61.5) into which the estimate calculated from the Preston-Bennett technique also fits nicely. But the estimate of the birth rate shows considerable variation with the assumed value of child mortality (as does the death rate computed by subtracting the intercensal growth rate from the birth rate estimate). However, it is possible to narrow down the range. It is

unlikely that the child death rates from the SRS and the estimates of e_5 from the intercensal analysis are simultaneously correct, since together they would imply an implausible age pattern of mortality, with extraordinarily high child mortality. As we have seen in Chapter 2, the e_5 values computed from the unadjusted SRS death rates for the mid-1970s were around 58 years. On the other hand, the graduated q(2) of 0.125 from the 1979 survey is probably too low as it implies incredibly high overestimation of child mortality in the SRS. Also, as pointed out in Chapter 2, the graduated q(2) value is probably affected by the underreporting of dead children by older women in the 1979 survey. Thus the raw q(2) from the 1979 survey seems to provide the most satisfactory set of demographic measures for the 1971-81 decade if both of the censuses were more or less equally complete. Accordingly, we conclude that, on the basis of intercensal analysis at least, the birth rate was 35-36 per 1,000 and e_0 was 54-55 years during the past decade.

NOTES

1. The South model mortality pattern was employed throughout the intercensal analysis. The standard life table used was computed from male and female South life tables at level 11 using the equation: $lx = (1.05lxm + lxf)/2.05$. Given that the value of 12 was fixed, a value of β (the level parameter in the two-parameter model life table system) could be calculated for each value of β. Together, the α and β values were applied to the standard South life table to generate the life tables incorporating a wide range of relationships between adult and child mortality.
2. For details of the adjustments that were made to allow for both changes in state territorial jurisdiction and migration see Dyson (1979b).
3. The age-specific fertility rates for a state used in this procedure were those for that state in the 1972 Fertility Survey (see India, Registrar General, 1976b), after adjustment for the half-year age displacement in this source. These rates were applied to the unadjusted average number of women in each age group over the 1961-71 period by state to estimate the average annual births over the decade if the all-India rates had prevailed. The ratio of "actual"

birth rates from Table 36 to expected rates is then applied to the states' total fertility rate to yield the figures in columns 5 and 6.

4. The 1969 age-sex-urban-rural specific death rates are taken from India, Registrar General (1972c). Rates for 1970 and 1971 are taken from India, Registrar General (1975b, 1977d). For each age, urban and rural figures are weighted by urban and rural proportions for all-India as recorded in the 1971 census.

   These age-specific rates were converted into 10-year survival proportions for the population aged x to x + 5 at the first census by the formula

$$\exp\left[-(2.5{}_5M_x + {}_5M_{x+5} + 2.5{}_5M_{x+10})\right].$$

   For the interval starting at ages 65-70 the survival proportion was

$$\exp\left[-(2.5{}_5M_{65} + 7.5\, M_{\infty 70})\right].$$

   For the open-ended interval starting at age 70 in 1961, the survival proportions were developed by reference to model stable populations. The model used was South with r = .0225 and level 13 for males and 10 for females (for more details, see Preston et al., 1979).

5. Inconsistencies between intercensal population change and SRS female mortality may also arise because the SRS figures pertain to the end of the decade, whereas intercensal experience is centered on 1966. A sharp decline in female mortality could account for some of the discrepancy. The fact that the census ratio of males to females actually rises substantially casts some doubt on the existence of a female-dominated mortality decline, and we know of no other information that would corroborate it.

6. The survival rate from 70+ to 80+ was left unchanged because it was not a product of the SRS data. All other survival rates in Table 38 were raised to the power 1.1111.

4 INTEGRATION OF ESTIMATES

This chapter draws together estimates appearing at different points in this report, with the aim of identifying and resolving inconsistencies and of producing a final assessment of India's vital rates.

4.1 CRUDE BIRTH RATES

Table 39 displays the various series of estimates of crude birth rate that have been produced. They reflect an extremely wide variety of procedures, and as a result what appear to be trends may simply reflect the differential impact of error, widespread in Indian data, on the results of the various techniques.

In this regard it is reassuring to note that there is a very high correlation among the various series. States in northern India--Rajasthan, Haryana, Uttar Pradesh, Assam, and Madhya Pradesh--have birth rates above the mean in each of the five series. The southern-most states--Kerala, Tamil Nadu, Karnataka, Maharashtra, and Andhra Pradesh--are below the mean in each of the five series. Bihar resembles the northern group in the three series in which it reliably appears; Gujarat also leans in the northerly direction. Orissa and West Bengal, forming a contiguous area in East India, show no persistent deviation from the all-India averages. Only Punjab violates the north/south dichotomy, being a below-average state in each of the five series by about 4-5/1,000. The regional picture appears remarkably clear in view of the extraordinary diversity of procedures and data used: census age distributions combined with survey estimates of child mortality (columns 1 and 2); fertility survey questions on births in the previous year and

TABLE 39 Summary of Crude Birth Rate Estimates: Selected States and All-India

State	1961-71 from Intercensal Analysis, Mean of Reverse and Forward Survival	1966-71 Reverse Survival from Adjusted 1971 Census	1971-72 from P/F Applied to 1972 Survey	1976 from Adjusted Deaths Plus Inferred Growth Rate	1979 from the SRS, Corrected by State-Specific Incompleteness Estimate for 1971-72
	(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	38.4	40.1	36.7	35.1	34.0
Assam	46.6	44.0	43.4	40.7	38.3
Bihar	41.0	42.0	(33.2)[a]	n.a.	38.4[b]
Gujarat	41.4	39.2	42.0	42.5	38.3
Haryana	44.0	44.4	43.3	41.0	39.9
Karnataka	39.3	36.4	35.9	36.7	33.2
Kerala	34.8	34.5	32.6	35.2	27.6
Madhya Pradesh	45.0	46.7	40.8	41.3	39.8
Maharashtra	39.1	39.8	35.2	35.8	30.6
Orissa	42.3	39.8	39.6	35.4	36.2
Punjab	35.1	35.5	35.9	36.4	30.9
Rajasthan	43.8	43.8	42.3	43.7	36.9
Tamil Nadu	36.8	37.5	35.4	34.1	32.2
Uttar Pradesh	44.0	44.7	44.5	42.8	40.2
West Bengal	40.5	40.7	n.a.	n.a.	32.7[b]
All-India	40.9	41.2	39.3	39.1[c]	36.0

Note: n.a. = not available.

[a]Believed too low, adjusted in all-India figures.
[b]Unadjusted figure for the new sample area, 1979.
[c]Excludes Bihar and West Bengal.

parity (column 3); age distributions of population and deaths by age in the SRS (column 4); and SRS births corrected by estimates of underregistration (column 5).

Because the five series are derived in different ways, it is dangerous to infer trends by comparing them. Nevertheless, there is a good deal of interest in knowing the course of Indian crude birth rates, and we cannot avoid comment. The general indication from Table 39 for all-India is one of a slow decline in birth rates of about 2/1,000 from about 1966 to 1976, followed by a faster decline thereafter. This pattern is roughly consistent with the performance of family planning programs (Visaria and Visaria, 1981), and the acceleration coincides with the emergency-related intensification of population control measures in 1976. However, this timing pattern is not consistent with that of SRS crude birth rates (Table 24), which show a decline of about 2.5 between 1971 and 1976, followed by a decline of 1.3 between 1976 and 1979. The impression from the SRS is one of a relatively steady pace of decline during the 1970s (except for 1973 and 1974, when SRS performance deteriorated). The two series could be reconciled if the Table 39 estimate for 1975-76 were lowered by about 1.5 points, and it seems likely that the original estimate is biased upward by declining mortality (or possibly fertility), as seems evident for Kerala.

State birth rate trends are also subject to method-specific error. Nevertheless, a clear impression emerges from Table 39 that all regions have shared roughly equally in the birth rate decline, although they started from different levels. This impression is confirmed in Table 40. There is no substantial difference in the pace of decline among the northern, southern, and intermediate groups of states. Of course, there is no assurance that the same factors underlie the trends in various regions. For example a larger fraction of the decline in the north may be attributable to the larger declines in child mortality, and their associated age distributional disturbances, that occurred there. It is also possible that SRS completeness deteriorated during the 1970s in the north relative to other regions. A state-specific analysis of intercensal growth 1971-81 presented below indicates that, in Rajasthan and Uttar Pradesh, growth did not decelerate as much as is implied by SRS figures.

Not shown in Table 39 is our estimated CBR for all-India based on intercensal analysis for 1971-81. The decadal value of 35.3 (using South Asia life tables and a

TABLE 40 Changes in Mean Crude Birth Rates in Groups of States Between Approximately 1968 and 1978: All-India

	Mean Crude Birth Rate 1961-71, 1966-71, 1971-72	Mean Crude Birth Rate, 1975-76, 1979	Approximate Decadal Decline
High Fertility, North (6)			
Assam, Bihar, Haryana, Madhya Pradesh, Rajasthan, Uttar Pradesh	43.66	39.97	3.69
Low Fertility, South (5)			
Andhra Pradesh, Karnataka, Kerala, Maharashtra Tamil Nadu	38.83	33.45	3.38
Others and Intermediate (4)			
Gujarat, Orissa, Punjab, West Bengal	39.39	35.64	3.75

Source: Table 39.

q(2) = .143) is inconsistent with the value of 36.0 for 1979 that assumes SRS completeness to have been constant from 1971-72 to 1979. It seems likely that SRS completeness improved during the decade, implying that SRS declines in birth rates have underestimated the declines that have actually occurred. Alternatively, we may have underestimated completeness by up to five percentage points for 1970-73. We believe that the intercensal figures for all-India are more reliable in view of the multitude of errors that could have crept into SRS and our analysis of its completeness: deficient population bases for computing vital rates; national unrepresentativeness of SRS; errors in age reporting that would affect completeness estimates; small numbers of events in the age-state data cells that are the basis of completeness estimates; errors in published data (which appear to be prominent in India), and so on.

The intercensal figures are not themselves free of error. A more refined intercensal analysis based on a simulation of "true" demographic conditions, presented

below, produces a somewhat higher intercensal CBR that is more consistent with our corrections of SRS data, and it yields what we consider to be the best estimate of all-India birth rates for 1971-76 and 1976-81.

4.2 TOTAL FERTILITY RATES

Estimates of total fertility rates are less reliable than those of crude birth rates because they require information on the age pattern of fertility as well as on its volume. As discussed above, age reporting in India is not accurate by international standards. In addition, there is only one source of information about the age pattern of fertility by state, the 1972 Fertility Survey. The 1979 survey provided figures at the national level. The figures resulting from analysis of these sources are repeated in Table 41 as are the implied total fertility rates based on indirect standardization of crude birth rates in the 1961-71 decade.

The level and trend in TFRs shown in Table 41 are somewhat different from those derived by other analysts who have examined the same data. Both the all-India estimates for 1971-72 and that for 1979 are below the levels previously estimated, by .2-.5 children per woman. The reasons we take issue with previous studies are described in Chapter 2. In addition to differences in technique, there were differences in data availability. We had last-minute access to the 1981 census age distribution, which encouraged us to reduce fertility estimates when uncertainties arose (as they did, particularly in the case of Uttar Pradesh).

The upshot is that we estimate that fertility has declined more than is generally believed. We calculate the decline to be slightly more than one child per woman between (approximately) 1966 and 1978.

4.3 CRUDE DEATH RATES

The two major sources of estimates for the crude death rates are intercensal analysis for the 1961-71 decade and death rates produced by the SRS since 1970, corrected for estimated underregistration. These figures are presented in Table 42. In the case of the SRS estimates, the completeness is assumed to be .9 throughout the decade and in each state, and rates presented in the SRS Bulletins

TABLE 41 Summary of Total Fertility Rate Estimates: Selected States and All-India

State	1961-71: Total Fertility Rate Based on Intercensal Analysis, Mean of Forward and Reverse Projected Procedures, Indirect Standardization for a State Using 1971-72 as Standard	1971-72: Based on P/F Applied to 1972 Fertility Survey	1978: Based on Intersurvey Comparison 1972-79 of Parity and Births Last Year
Andhra Pradesh	5.01	4.80	
Assam	6.85	6.35	
Bihar	5.62	(4.75)[a]	
Gujarat	5.83	5.97	
Haryana	6.91	6.64	
Karnataka	5.51	5.50	
Kerala	4.70	4.49	
Madhya Pradesh	6.40	6.16	
Maharashtra	5.29	4.92	
Orissa	5.72	5.54	
Punjab	5.52	5.57	
Rajasthan	6.34	6.38	
Tamil Nadu	4.66	4.58	
Uttar Pradesh	6.45	(6.89)[b]	
West Bengal	5.93	n.a.	
All-India	5.72	5.60	4.69

Note: n.a. = not available.

[a]Believed too low, corrected in the all-India figures.
[b]Believed too high, set at 6.45 for all-India figures.

TABLE 42 Crude Death Rates Estimated from Various Sources: Selected States and All-India

State	1961-71 from Reverse Survival	1961-71 from Forward Survival	Adjusted Estimates from the SRS		
			1970-73	1974-76	1977-79
Andhra Pradesh	19.9	18.7	17.5	16.6	14.9
Assam	18.0	16.7	(19.0)	(18.0)	13.9
Bihar	22.3	19.5	--	--	16.8[a]
Gujarat	15.8	16.1	17.9	16.2	15.0
Haryana	16.9	16.3	(12.0)	14.0	14.0
Karnataka	18.1	17.4	14.0	12.4	12.4
Kerala	9.4	11.3	10.0	9.0	7.8
Madhya Pradesh	21.5	19.6	18.8	18.8	17.8
Maharashtra	16.6	15.9	14.1	12.7	12.6
Orissa	20.6	20.3	19.5	18.3	16.9
Punjab	14.5	13.9	12.9	12.0	12.0
Rajasthan	18.6	17.8	18.4	16.6	16.0
Tamil Nadu	15.8	17.0	16.4	16.1	14.3
Uttar Pradesh	26.0	23.8	24.1	23.3	20.6
West Bengal	17.1	17.4	--	--	13.4[a]
All-India	19.1	18.4	17.8[b]	16.9[b]	15.5[b]
All-India (except Bihar and West Bengal)			17.7	16.8	15.4

Note: Figures of questionable validity are in parentheses.

[a]1979 only, from new sample areas, corrected by assuming 10 percent underregistration.

[b]All-India results without Bihar and West Bengal are raised by 0.1/1,000, the mean of the effects of including thee areas in 1979 (new sample areas) and in the two 1961-71 intercensal estimates (state-weighted).

are thus divided by .9. The lack of demonstrable interstate differences (except for Bihar and West Bengal) was suggested in Chapter 2.

Combining the two basic procedures produces a picture of smoothly declining crude death rates for all-India. The mean of the two intercensal procedures for 1961-71 is a crude death rate of 18.75; according to adjusted SRS figures, this rate declined to 17.8 in 1970-73, to 16.9 in 1974-76, and to 15.5 in 1977-79.

The juxtaposition of the two data series for states in Table 42 creates little disjunction. The series are highly correlated with one another, as in the case of crude birth rates. Uttar Pradesh, Madhya Pradesh, Bihar, and Orissa are the highest-mortality states in the intercensal analysis, just as they are in 1977-79. Kerala and

Punjab are the lowest-mortality states in all series. So there is a north/south gradient in mortality, as in fertility, but it differs in some major respects. Orissa in East India, intermediate in fertility levels, clearly belongs with the high-mortality northern group. Haryana, in the high-fertility northern group, is closer to neighboring and exceptional Punjab in its low crude death rate.

The SRS crude death rates of most questionable validity are those for Assam in 1970-73 and 1974-76. Both numbers are substantially higher than the intercensal figures or than figures for 1977-79. It may be recalled that Assam was estimated to have 17-percent overregistration of deaths by the Brass and Preston-Coale procedures for the period 1970-76; something seems clearly amiss with these figures, but it is not at all clear what the problem may be. The Haryana figure for 1970-73 seems too low; the recorded crude death rate was increasing during this period, presumably as registration completeness was improving.

As in the case of crude birth rates, there is relatively little regional differentiation in death rate trends. The three states with the largest declines in crude death rates in Table 42 (comparing the far left and far right columns) are Andhra Pradesh, Uttar Pradesh, and Karnataka. These are three of the five states that had an acceleration in intercensal growth between 1961-71 and 1971-81. This correspondence not only helps to confirm the validity of estimated trends in crude death rate but also suggests the important role of changing death rates in accounting for changing of patterns of regional growth.

As in the case of the crude birth rate, our 1971-81 intercensal analysis in Chapter 3 produces a lower crude death rate (13.2 per 1,000) for the decade than is implied by our correction of SRS figures. Once again, the refined intercensal analysis based on simulations presented below produces an intermediate figure that we accept as most reliable.

4.4 CHILD MORTALITY

The various estimates of child mortality were thoroughly described and compared in Chapter 2 and there is no independent set of estimates emerging from other sections of the report. The most important summary tables in that section are Tables 11 and 17. Analysis and evaluation of

two surveys asking questions on children ever born and children surviving indicate that the all-India q(2)--the proportion of live births dying before age 2--had declined from .225 in 1961 to .164 in about 1968. This major reduction in mortality must have led to a substantial growth acceleration, which would have affected intercensal growth in 1961-71 relative to 1971-81, since the lower level would have pertained throughout the later decade but for only part of the earlier one.

There is less solid ground for estimating the trends in all-India child mortality since 1968. A 1979 survey produced an estimated q(2) of .125 which would pertain approximately to 1975. But the implied continued rapid decline in child mortality between 1968 and 1975 is not confirmed by the SRS data on infant mortality rates or on death rates below age 5 in the first half-decade of the 1970s (see Table 7). The latest age-specific death rates published by the SRS are for 1977, and they show a death rate below age 5 ($_5M_0$) of 50.9/1,000 (India, Registrar General, 1980b:12). The $_1q_0$ in the SRS life table for 1976-77 is .131. Both figures pertain to all-India except Bihar and West Bengal. Equivalent figures for the SRS in 1970-72 are 54.6 and .132 (unpublished data supplied by the Registrar General). This is only a 7-percent decline in $_5M_0$, compared with an implied 24-percent decline in q(2) from intersurvey comparisons. The high level of child mortality shown in SRS is called into question in Chapter 3, where it is shown to imply (when compared with apparent intercensal adult mortality conditions) an anomalous age pattern of mortality. The inconsistency between these sources is further addressed below by examining the degree to which their implications agree with intercensal growth and age distributional changes.

4.5 LIFE EXPECTANCY

The two basic sources for computing life expectancy are intercensal analysis combined with child mortality estimates and direct use of age-specific death rates from the SRS. Because very small numbers of deaths are involved at most ages in the SRS state data, we have not attempted to make life expectancy estimates by state from the SRS data. The 1961-71 life expectancy estimates by state are shown in Table 35.

The all-India results are presented in Table 43. In three columns we have presented life expectancy values after correction of all SRS age-specific death rates above age 5, assuming in accordance with analysis in Chapter 2 that registration of female deaths was 87-percent complete and that of male deaths was 93-percent complete.[1]

For life expectancy at age 5, the agreement between SRS and intercensal analysis is reasonably good. The life expectancy of 59.8 for the latter is within two years of the (two-sex mean) of uncorrected SRS figures for 1971 and 1977 and within 3.5 years of the corrected SRS figure. The period 1972-73 was one of economic distress in India and estimates for this period are further from the intercensal average. It should be remembered that a large mortality improvement occurred in 1979 and 1980 that is not reflected in the SRS figures in Table 43.

A larger disparity of 4-6 years occurs in the case of life expectancy at birth. This increase in the disparity simply reflects the fact that we have used a survey-based estimate of child mortality for intercensal analysis that is substantially lower than that contained in the SRS. We conclude below that the bulk of evidence supports the lower, survey-based figure.

The SRS-based life tables exclude Bihar and West Bengal. Judging from a comparison of state-weighted intercensal estimates with and without these states (based on Table 35 in Chapter 3), including these states would lower e_0 by 0.05 years for males and 0.20 for females.

4.6 COMPARISON OF ESTIMATED LEVELS OF CRUDE BIRTH RATES AND DEATH RATES TO INTERCENSAL GROWTH, 1971-81

As noted earlier, the intercensal growth rate (continuously compounded) between the 1971 and 1981 censuses was .0222.[2] Since there is little international migration in India, relative to its size, this figure should be close to the difference between crude birth and death rates during the intercensal period. It may differ if either birth rate or death rate estimates are erroneous or if the intercensal growth rate is distorted by differential completeness between the two censuses.

For purposes of this comparison, birth and death rates used for the intercensal period will be those for 1971-80. The mean SRS unadjusted crude death rate for all-India

TABLE 43 Life Expectancy Estimates from Various Sources: All-India

	Intercensal Analysis 1961-71	Based on Uncorrected SRS Data[a]			Based on Corrected SRS Data, Assuming Above Age 5 Female Completeness of .87; male of .93[a]			Based on 1971-81 Intercensal Analysis
		1971	1972-73	1977	1971	1972-73	1977	1971-81
Life Expectancy at Birth								
Male	46.8	50.2	48.9	50.7	49.3	48.1	49.8	54.0
Female	45.3	49.4	47.1	49.4	47.7	45.4	47.6	
Life Expectancy at Age 5								
Male	55.4	57.9	56.8	58.0	56.8	55.8	57.0	59.8
Female	53.7	58.4	56.6	58.3	56.2	54.4	56.1	

[a]Excludes Bihar and West Bengal.

(except Bihar and West Bengal) in 1971-80 is 14.68 (including an actual figure for 1980 not presented in Table 18). The estimated registration completeness for this area is .90, so the corrected death rate is 16.3.

The mean SRS crude birth rate from 1971-80 for all-India (except Bihar and West Bengal) is 34.49. Survey-based estimates in Chapter 2 indicate that birth registration was about 7.8-percent deficient in 1970-73, and we assume that this is constant during the decade; the corrected crude birth rate is 34.49/.922 = 37.4. This figure implicitly adopts the timing pattern of SRS birth rate declines.

Thus, the difference between intercensal birth and death rates implied by the estimates and procedures used in this report is 37.4 - 16.3 = 21.1 per 1,000. If, as we have estimated, approximately 0.8 percent of females were omitted from the 1971 census relative to censuses of 1961 and 1981, then the true intercensal growth rate should have been .0218.

Our estimates of decadal birth and death rates have thus underestimated observed population growth by about 0.7 per 1,000. While net inmigration from Pakistan and Bangladesh may account for some of the disparity, it seems likely that we have either slightly underestimated birth rates or slightly overestimated death rates, or both.

Similar comparisons are made for major states in Table 44. The mean SRS unadjusted crude birth and death rates for 1971-80 are computed from the annual figures presented in Tables 18 and 24. Since rates for 1980 were not available, 1979 figures are repeated for 1980. As in the case of the all-India procedure, estimates of SRS completeness for the early years of the 1971-80 decade are assumed to pertain throughout the decade. The state estimates of completeness of birth registration in SRS are taken from Table 31. The conclusion from Chapter 2, Section 2.2, was that there was relatively little demonstrable variation among the states in the completeness of death registration, so the all-India estimate of 90-percent completeness is used in correcting recorded death rates of each state. One exception to this procedure, however, occurs in Assam. The application of both the Brass and the Preston-Coale techniques had suggested considerable overreporting of deaths in that state, though operational reasons for this are not known. Incorporated in Table 44 for this state is its unadjusted SRS death rate.

TABLE 44 Comparison of Estimated Levels of Crude Birth and Death Rates with Intercensal Growth Rates for 1971-81: Selected States of India

State	Corrected Mean SRS Crude Birth for 1971-80[a]	Corrected Mean SRS Crude Death for 1971-80[a]	Estimated Crude Rate of Natural Increase for 1971-80	Intercensal Growth Rate for 1971-81	Intercensal Growth Rate for 1961-71	Estimated Crude Rate of Natural Increase for 1961-71[b]	Recorded Increase in Intercensal Growth Rate from 1961-71 to 1971-81	Estimated Increase in Crude Rate of Natural Increase from 1961-71 to 1971-80
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)	(7)=(4)-(5)	(8)=(3)-(6)
Andhra Pradesh	35.8	16.1	19.7	21.0	18.8	19.0	2.2	0.7
Assam	39.0	(15.0)	(24.0)	n.a.	29.6	28.8	n.a.	(-4.8)
Bihar	n.a.	n.a.	n.a.	21.7	19.2	20.1	2.5	n.a.
Gujarat	39.9	16.1	23.8	24.6	25.6	25.3	-1.0	-1.5
Haryana	41.3	13.3	28.0	25.5	27.7	27.1	-2.2	0.9
Karnataka	33.4	12.8	20.6	23.9	21.5	21.3	2.4	-0.7
Kerala	29.3	8.8	20.5	17.7	23.2	24.4	-5.5	-3.9
Madhya Pradesh	40.4	18.3	22.1	22.7	25.0	24.2	-2.3	-2.1
Maharshtra	32.6	13.1	19.5	22.1	24.1	22.6	-2.0	-3.1
Orissa	37.2	18.2	19.0	18.5	22.2	21.6	-3.7	-2.6
Punjab	33.5	12.2	21.3	21.6	19.5	20.8	2.1	0.5
Rajasthan	38.7	16.6	22.1	28.7	24.4	25.5	4.3	-3.4
Tamil Nadu	34.2	15.3	18.9	16.3	20.0	20.3	-3.7	-1.4
Uttar Pradesh	42.2	22.2	20.0	22.9	17.9	19.2	5.0	0.8
West Bengal	n.a.	n.a.	n.a.	21.0	23.6	23.0	-2.6	n.a.

Notes: Figures of questionable validity shown in parentheses; n.a. = not available

[a]As figures for 1980 were not available, rates for 1979 were repeated for 1980. For the method of correction for underregistration, see text.

[b]Estimated from intercensal growth rates for 1961-71 shown in column 5, and net migration rates shown in Table 33.

Source: India, Registrar General (1975a, 1982), and Tables 18, 24, 31, 33 of this report.

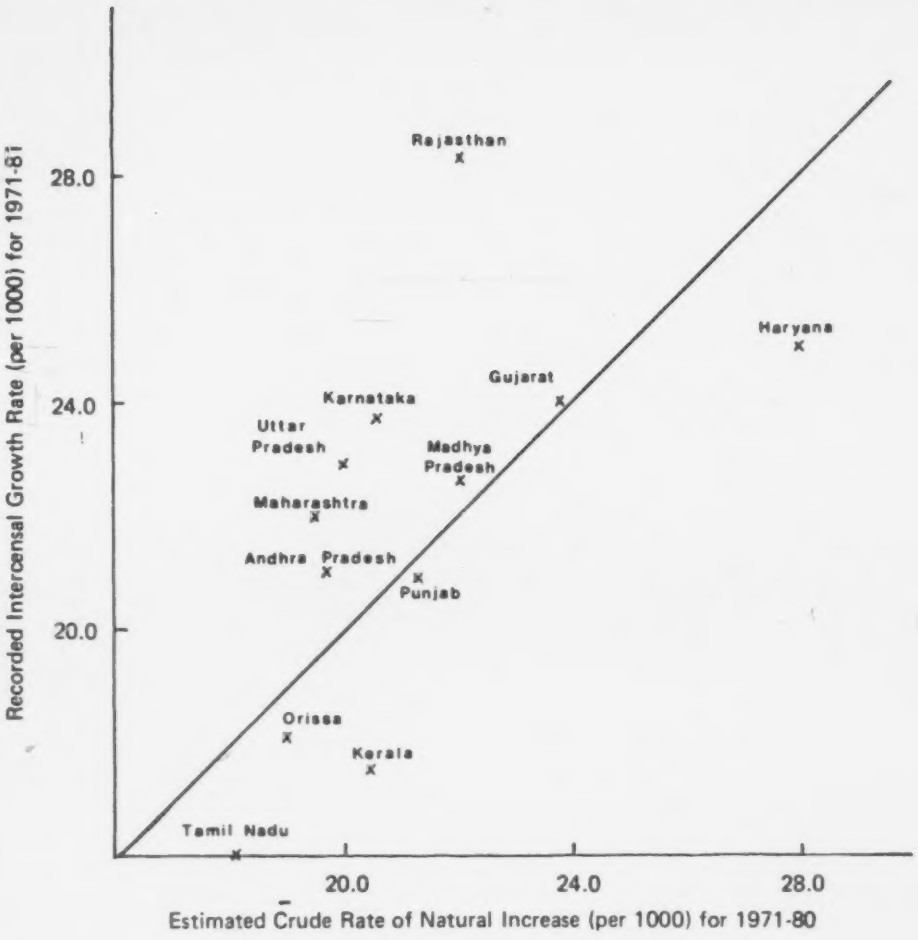


FIGURE 7 Comparison of 1971-81 Intercensal Growth Rates and Crude Rates of Natural Increase, by State

Column 3 of Table 44 provides the state estimates of crude rate of natural increase (per 1,000) for 1971-80 computed on the above basis. In Figure 7 these estimates are plotted against intercensal growth rates recorded for 1971-81. The results show a reasonable degree of consistency. The overall correlation between the two series is 0.61; when Rajasthan (where the estimate of crude rate of natural increase is 23 percent lower) is excluded, the

correlation coefficient rises to 0.69. A less than perfect correlation may result from many sources: internal migration (reflected in intercensal growth but not in crude rates of natural increase); differential census coverage completeness; and errors in the estimated series of birth and death rates.

It is also useful to know how accurately our estimates of crude rate of natural increase can predict the observed changes in the intercensal growth rates from 1961-71 to 1971-81. The last two columns of Table 44 compare the recorded increase in intercensal growth rates from 1961-71 to 1971-81 with the estimate of increase in crude rate of natural increase in the same period, state by state. In three states only--Rajasthan, Haryana, and Karnataka--do we incorrectly predict the direction of the trend in growth rates. Another glaring anomaly is Uttar Pradesh. The 1981 census reveals considerable more acceleration in growth rate than we "anticipate" for this state. The correlation between the two series is 0.47, but if Rajasthan is excluded it rises to 0.76. In Rajasthan, where unadjusted SRS birth rates have shown a sharp downward trend (2.2-percent average annual rate of decline during 1970-79 compared with the all-India figure of 1.3 percent) our assumption of constant SRS completeness is called into question., It is also possible in this state that immigration from Pakistan (Mukerji, 1982) and Haryana, and/or relatively better enumeration in the 1981 census, have contributed to the deviation of the observed growth rate from the one predicted. The SRS death rates for Haryana, especially those for the early 1970s, may have needed slightly higher correction for underreporting than the 10 percent assumed. Figures for Karnataka and Uttar Pradesh are probably affected by a mix of factors such as in-migration, changing completeness of birth registration in the SRS, and differential completeness of 1971 and 1981 censuses.

Thus, the overall agreement between estimates of crude rates of natural increase by state and intercensal growth rates can be described as fair to good, but far from perfect. There is evidently a good deal of room for error in either or both series, particularly in the two northern states of Rajasthan and Uttar Pradesh. The very large intercensal growth acceleration in these two states is not predicted by our estimated trends in vital rates. Elsewhere, however, the correspondence between the two series, and their changes, is quite good.

4.7 THE CONSISTENCY OF ESTIMATED AGE-SPECIFIC RATES WITH OBSERVED TRENDS

The growth in population between the 1971 and 1981 censuses is reasonably consistent with the estimated trends in crude rates of birth and death. But these crude rates provide only indirect support for the sets of age-specific rates with which they are associated. Age misreporting has no effect on crude rates in the SRS, for example, but it could and almost certainly does influence life expectancy based on SRS age-specific death rates.

In order to see whether our estimated age- and sex-specific rates are consistent with available external evidence, such as intercensal growth rates and sex ratios from the 1981 census, we performed a simulation exercise that uses our estimated age-sex rates as input. The simulation takes the form of a two-sex population projection in five-year increments of age and time. Female births are derived by combining assumed age-specific fertility rates with the estimated number of women by age. Male births are derived by assuming a sex ratio at birth of 1.05. The base point of the projection is March 1, 1966, approximately halfway between the censuses of 1961 and 1971. Zero net international migration is assumed. The main steps are the following:

1. Estimate the population age distribution by sex in 1966 using a procedure presented in Preston and Coale (1982). This procedure derives an age distribution entirely from data on age-specific growth rates, here assumed to be those observed between the 1961 and 1971 censuses, combined with the prevailing life table. The intercensal life table estimated in Chapter 3 is used for this purpose. The resulting age-sex distribution is shown in Table 45.

2. Age-specific fertility rates. From above, the estimated total fertility rate estimated for 1961-71 was 5.72, and for 1971-72 it was 5.60. The interpolated value of 5.668 was used for the 1966-71 period. Age-specific fertility rates recorded in the 1972 Fertility Survey were scaled to a TFR of 5.668 after they were corrected for the half-year age displacement present in birth-last-year reports. For the period 1971-76, age-specific fertility rates were interpolated between the corrected values for 1971-72 (TFR = 5.60) and 1978 (TFR = 4.69). The interpolated TFR is 5.366. For the period

TABLE 45 Estimated and Projected Age Distributions (in 1,000s) Based on Assumed Age-Specific Fertility and Mortality, 1966-81: All-India

Age at Start of Interval	1966 Male	1966 Female	1971 Male	1971 Female
0	40,502	37,878	44,862	42,456
5	33,521	31,391	37,951	35,179
10	28,487	26,650	32,895	30,739
15	23,907	22,565	28,086	26,203
20	20,702	19,998	23,454	22,023
25	18,793	18,176	20,231	19,426
30	17,174	16,213	18,329	17,616
35	15,101	13,882	16,671	15,652
40	12,939	11,757	14,555	13,349
45	10,976	10,004	12,344	11,221
50	9,239	8,466	10,246	9,369
55	7,565	6,901	8,369	7,729
60	5,839	5,289	6,562	6,006
65+	8,478	7,686	9,693	8,713
All-India	253,211	236,854	284,248	265,680
	1976		1981	
0	48,690	45,665	49,189	46,204
5	42,728	39,993	46,709	43,446
10	37,315	34,457	42,129	38,287
15	32,545	30,268	36,932	34,004
20	27,731	25,640	32,158	29,721
25	23,110	21,480	27,356	25,082
30	19,873	18,905	22,739	20,996
35	17,882	17,088	19,458	18,467
40	16,108	15,134	17,326	16,634
45	13,842	12,783	15,368	14,625
50	11,458	10,526	12,901	12,143
55	9,164	8,528	10,298	9,708
60	7,075	6,661	7,780	7,471
65+	10,758	9,823	12,215	11,634
All-India	318,278	296,951	352,558	329,421

1976-81, we used the adjusted values for 1978 from the 1979 survey. The calculations to obtain the age-specific fertility rates are shown below:

Age	1966-71	1971-76	1976-81
15-19	.1105	.1042	.0896
20-24	.2825	.2736	.2576
25-29	.2837	.2714	.2457
30-34	.2178	.2033	.1688
35-39	.1424	.1328	.1099
40-44	.0724	.0653	.0475
45-49	.0243	.0227	.0189
TFR	5.668	5.366	4.690

3. Life tables used. As noted above, there was an inconsistency between mortality levels indicated in the 1979 Survey of Infant and Child Mortality and the crude and age-specific rates derived from SRS in the latter part of the 1970s. The SRS child mortality rates are substantially higher. We have therefore used two variants for mortality, a high variant and a low variant:

High-Mortality Variant

1966-71. Mean of life table l_x values for 1961-71 and 1971. The 1971 life table is that of SRS for 1971, corrected above age 5 for .93 registration completeness for males and .87 for females. Parameters of these tables are shown in Table 43.

1971-76. Life table based on mean SRS age-specific death rates for the period 1971-75, after correction above age 5 for .93 registration completeness for males and .87 for females.

1976-81. The basis of the life table is the set of average age-specific death rates for SRS in 1976-78. These were scaled to agree with the crude death rate for the 1976-80 period in SRS. Rates above age 5 were then divided by .93 for males and .87 for females.

Low-Mortality Variant

1966-71. Mean of life table l_x values for 1961-71 and 1971. The 1971 life table is constructed by interpolating between the 1972 Fertility Survey estimate of q(2) = .164 and the 1979 survey estimate q(2) of .143 (after assignment of these values to their proper reference dates) and choosing the corresponding values of mortality under 5 in the South model life table system. The SRS sex differences in mortality below 5 are assumed to be correct. Above age 5, SRS age-specific death rates are divided by .98 for males and .92 for females. This procedure keeps the identified sex difference in mortality but reduces adult incompleteness to 5 percent.

1971-76. Below age 5, the interpolated values of q(2) between the 1972 and 1979 surveys is used to identify the appropriate mortality level in the South model life table system. Above age 5, SRS age-specific death rates for 1971-75 are divided by .98 for males and .92 for females.

1976-81. Below age 5, the extrapolated value of q(2) from the 1972 and 1979 surveys is used to identify the appropriate mortality level in the South model life table system. Above age 5, the same procedure is used as in the higher-mortality variant except that death rates above age 5 are divided by .98 for males and by .92 for females.

The values derived for the two variants are are presented below:

	1966-71		1971-76		1976-81	
	e_0	e_5	e_0	e_5	e_0	e_5
High Variant						
Male	48.1	56.1	48.7	56.3	51.3	57.7
Female	46.5	55.0	46.5	55.2	50.4	58.0
Low Variant						
Male	49.2	56.5	51.7	57.1	53.7	58.5
Female	47.7	55.4	49.7	56.0	53.1	58.9

TABLE 46 Principal Results of Demographic Parameters Using High- and Low-Mortality Variants and Compared with Values from the Sources: India

Parameter	High-Mortality Variant	Low-Mortality Variant	Value from Other Sources for 1971-81 Intercensal Period or for 1981
Growth Rate, 1971-81	20.1/1,000	21.5/1,000	22.2/1,000 (21.8/1,000 after correction for missing females in 1971
Crude Birth Rate, 1971-81	36.3/1,000	35.9/1,000	SRS = 34.5 uncorrected or 37.4 corrected for 7.8-percent under-registration
Crude Death Rate, 1971-81	16.2/1,000	14.4/1,000	SRS = 14.7 uncorrected or 16.3 corrected for 10-percent under-registration
Total Population Size, 1981	669.856*	681.979*	685.159 million (including estimate for Assam and adjustment for Jammu and Kashmir
Sex Ratio of Population, 1981	1.072	1.070	1.070 in 1981 census (excluding Assam)

*In millions.

Principal results of the two variants are presented in Table 46.

Despite the relatively small differences in mortality parameters between the two variants, there are approximately 12 million fewer deaths with the low-mortality variant between 1971 and 1981. The larger 1981 population produced by this variant, together with the faster implied rate of intercensal growth, clearly distinguishes it

favorably from the high-mortality variant. Both figures are very close to those derived from the 1981 census. The implied 1981 sex ratio is also mildly in its favor when tested against the 1981 census. The low-mortality variant is also closer to uncorrected estimates of SRS crude birth and death rates for the period 1971-81. It implies that SRS crude birth rates are incomplete by 3.9 percent and that SRS crude death rates are too high by 2.0 percent (it was, of course, the inconsistency between survey results and SRS results for mortality that led us to create two mortality variants in the first place).

The only argument on behalf of the high-mortality variant is that it produces results closer to SRS crude birth rates and death rates after they are adjusted for estimated underregistration. But differences in CBRs are small (0.4 per 1,000) and differences in CDRs are meaningless since the high-mortality variant was constructed to include the 10-percent adjustment for estimated underregistration. So it is in no sense confirmatory when it produces results that are nearly identical to another series that is similarly adjusted. The main independent sources of information, the 1981 census and patterns of intercensal growth, give strong support to the low-mortality variant.

Table 45 presents estimates of the "true" age-sex distribution of India between 1966 and 1981 based on the low-mortality variant. The estimated age distribution for 1981 has a much lower proportion under 10 than in previous censuses, which is consistent with the sizable decline in fertility that we estimate to have occurred. In particular, the percentage below age 10 is estimated to have declined from 29.18 in 1971 to 27.21 in 1981. This decline compares to a reduction from 29.47 percent to 26.66 percent between the actual censuses of 1971 and 1981. Although we estimate a faster fertility decline than do other analysts (e.g., Jain and Adlakha, 1982), the census suggests that it may have been faster still (note, however, that estimated net omission rates under 10 rose slightly between 1971 and 1981).

The time sequence of vital rates estimated through the simulation procedure is shown in Table 47.

We believe that these figures, which incorporate many features from different parts of this volume, are the preferred demographic estimates for India from 1966 to 1981. Their one jarring implication is that SRS death reports are not incomplete; in fact, they may even be slightly too high, particularly as the decade of the

TABLE 47 Final Estimates of Vital Rates for Selected Periods, 1966-71 to 1976-81, All-India

Period	CBR	CDR	Rate of Natural Increase
1966-71	40.2	17.2	23.0
1971-76	37.9	15.5	22.4
1976-81	34.0	13.4	20.6
1971-81	35.9	14.4	21.5

1970s progresses. We believe further that SRS estimates of child mortality are too high by the last half of the decade. This very tentative conclusion would seem inconsistent with the Registrar General's belief that the SRS system was deteriorating slightly toward the end of the decade, unless the deterioration took the form of invented events or an increasingly incomplete population base. We have two additional observations on this subject.

First, as noted earlier, infant and below-5 mortality is overestimated to the extent that rounding ages upward deprives these age groups of their lowest-mortality segment. This tendency is strong in India; however, there is no reason to expect the tendency to have worsened during the decade.

Second, the age distribution of SRS is persistenly and inexplicably different from that of the censuses. These differences indicate that SRS is not fully nationally representative. Differences between national and SRS levels of crude death (and birth) rates may appear to be attributable to deficiencies in SRS (which they are, if it is supposed to function as a national representation), but they are not perfect indicators of the completeness of event recording is SRS itself. In this context it is worthwhile noting that a background paper prepared for the panel that applied SRS age-specific death rates to national (rather than SRS) age distributions, using the tests of section 2.2, found that SRS death registration is substantially better than reported in that section (Preston et al., 1979). It may be that SRS's age-specific

death rates are nationally representative but that migration or sample selection problems have distorted its age distribution and biased tests of registration completeness. It should also be reiterated that the tests of registration completeness applied in section 2.2 are biased downward by the mortality decline that has occurred in India.

Whatever the explanation, we conclude that SRS crude death rates do not require correction to serve as national representations and, more tentatively, that recorded SRS child mortality levels are too high for the mid-to-late 1970s. The state-specific estimates of crude death rates that are based on adjusted SRS figures are therefore probably too high, on average, by about 1.4 per 1,000 for the decade of the 1970s.

In light of these results, it is useful to reexamine state-specific vital rates using results based on the child mortality values contained in the 1979 survey. These are not available by state, so we have used the state pattern of child mortality provided by SRS.[3] We then applied the "integrated" method to state-specific intercensal age distributions for 1971-81.[4] Birth rate estimates derived from this procedure are far more robust to the kind of errors encountered in Indian data than are death rate estimates (Preston, 1983), and we have greatest confidence in the birth rate results.

Results are shown in Table 48. They are compared to unadjusted SRS birth rates for 1971-80 and to SRS birth rate estimates for 1971-80 adjusted by the factors (based on analysis of 1970-73 experience) presented in Table 31. The correspondence between the series is quite striking. In general, 1971-81 intercensal analysis strongly confirms the level of SRS birth rates except in Bihar and West Bengal, in which SRS rates are clearly too low. Other states in which the upwardly adjusted birth rates are closer to what is indicated by intercensal analysis and in which the upward adjustment is at least 5 percent are Karnataka, Maharashtra, and Rajasthan. The north/south gradient is strikingly maintained in the new intercensal series. So is the conclusion based on Table 40 that there is little regional differentiation in patterns of fertility decline. Comparing column 1 of Table 40 (intercensal analysis for 1961-71 by state) to the 1971-81 intercensal birth rates in Table 48 shows a mean decline in CBRs of 4.9 for the five northern states, 6.8 for the five southern states, and 4.7 for other and intermediate states.

TABLE 48 1971-81 Intercensal Birth Rate Estimates by State Based on Integrated Method and Compared to SRS Crude Birth Rate Estimates: All-India

State	Crude Birth Rate Based on Intercensal Population Change	Crude Birth Rate in SRS, 1971-80	
		Unadjusted	Adjusted[a]
Andhra Pradesh	33.2	33.4	35.7
Assam	--	32.9	38.9
Bihar	39.1	31.6	--
Gujarat	36.4	37.2	39.9
Haryana	37.1	37.8	41.3
Karnataka	33.1	28.9	33.2
Kerala	28.1	27.8	29.4
Madhya Pradesh	36.4	38.3	40.3
Maharashtra	31.2	29.1	32.8
Orissa	33.2	33.3	37.1
Punjab	31.7	31.7	33.5
Rajasthan	40.9	37.3	39.1
Tamil Nadu	30.2	29.9	34.2
Uttar Pradesh	40.4	41.5	42.1
West Bengal	37.5	30.5[b]	--
State weighted			
Above states excluding Assam[c]	35.7	34.0	
Above states excluding Assam, Bihar and West Bengal	35.0	34.7	37.2
Above states excluding Bihar and West Bengal		34.7	37.2

[a]By adjustment factors in Table 31, column 1.
[b]For 1974-80.
[c]Essentially all-India.

4.8 CONCLUSION

A final word is in order on Indian demographic statistics. The panel believes that a relatively precise picture of demographic circumstances in India has emerged in this report due mainly to the availability of overlapping sources of information. The SRS is performing a valuable

service in mapping yearly trends in crude birth and death rates, yet its products would have far less value if they could not be periodically tested against other information. Particularly important in this regard are surveys asking questions on lifetime births and child deaths. It is not sufficient simply to ask about these matters; the manner in which questions are asked and the data processed are critical determinants of the quality of results, as illustrated by the comparative value of the 1972 and 1979 surveys. And providing the foundation for all attempts to understand the demography of India are the extensive series of decennial censuses, mounted at great cost in a country in which competition for resources is intense. Even though much of the 1981 census remains to be published, several pieces of evidence derived from it have been a critical ingredient in establishing the set of estimates presented here.

NOTES

1. We did not correct death rates under age 5 because they are in good agreement with the q(x) value from the 1972 Fertility Survey. We believe that deaths below age 5 are incompletely registered in the SRS but that this bias is offset to some extent by age-misstatement that transfers the lowest-mortality ages under age 5 out of that age group.
2. The intercensal growth rate is calculated from the territory excluding Assam, for which census total for 1981 was not available. For the remaining territories, the enumerated population on March 1, 1981, was 665.262 million (India, Registrar General, 1983c). The census count of April 1, 1971, for the same territory was 533.535 million. The intercensal growth rate for this territory, continuously compounded is

   $$r = \ln (665.262/533.535)/9.917$$
   $$= .02225$$

   It is possible that the growth rate for the entire territory will differ slightly from this figure, but part of the difference will probably reflect net international migration into Assam.
3. In particular, the national q(2) estimate from the 1979 survey, when converted via the South model life

table system, implies a ${}_5M_0$ value (death rate for children under age 5) that is smaller by 23 percent than the corresponding value from the SRS for 1976. Thus, all state-specific values of ${}_5M_0$ from the SRS for 1976 were reduced by 23 percent before converting them to p(5) values using the South model system. For Bihir and West Bengal, the SRS rates were not available; in applying the integrated method, we assumed the child/adult mortality relationship in these states to be the same as in the standard life table.

4. A life table with an e_0 value of 50 years from the U.N. South Asia family was used as the standard. In every case, the line was fitted to data points for ages 5-30 and 35-55, using the grouped mean procedure.

APPENDIX A Regression Coefficients Used in Estimating Adjustment Factors k(i) When CEB/CS Data are Classified by Duration Intervals as Indicated, West Model Variant: All-India

Regression equation: $K(i) = a(i) + b(i)\frac{P(1)}{P(2)} + c(i)\frac{P(2)}{P(3)}$

Duration of Marriage	(i)	$\frac{q(x)}{D(i)}$	a(i)	b(i)	c(i)
0-5	1	q(2)/D(1)	1.2500	-0.2555	0.0195
6-9	2	q(3)/D(2)	1.1999	-0.2615	-0.0879
10-15	3	q(5)/D(3)	1.2322	0.0167	-0.3417
16-25	4	q(10)/D(4)	1.2561	-0.0542	-0.3722
26-35	5	q(20)/D(5)	1.1664	1.6023	-1.3668

Note: Based on level 12.

APPENDIX B Regression Coefficients Used in Estimating Adjustment Factors K(i) When CEB/CS Data are Classified by Age Intervals as Indicated, South Model Variant: All-India

Regression equation: $K(i) = a(i) + b(i)\frac{P(1)}{P(2)} + C(i)\frac{P(2)}{P(3)}$

Age Interval of Women	(i)	q(x) D(i)	a(i)	b(i)	c(i)
17-21	1	q(1)/D(1)	0.5047	-0.7884	0.9352
22-26	2	q(2)/D(2)	1.0143	-0.2942	0.0936
27-31	3	q(3)/D(3)	1.0835	-0.1417	-0.0657
32-36	4	q(5)/D(4)	1.0930	-0.1025	-0.0688
37-41	5	q(10)/D(5)	1.0982	-0.1002	-0.0469
42-46	6	q(15)/D(6)	1.0727	-0.0984	-0.0303

GLOSSARY

AGE HEAPING A tendency for enumerators or respondents to report certain ages instead of others; also called age preference or digit preference. Preference for ages ending in 0 or 5 is widespread.

AGE PATTERN OF FERTILITY The relative distribution of a set of age-specific fertility rates. It expresses the relative contribution of each age group to total fertility.

AGE RATIO The ratio of the population in a given age group to the average of the populations in the two neighboring age groups, times 100.

AGE-SPECIFIC FERTILITY RATE The number of births occurring during a specified period to women of a specified age or age group, divided by the number of person-years-lived during that period by women of that age or age group. When an age-specific fertility rate is calculated for a calendar year, the number of births to women of the specified age is usually divided by the midyear population of women of that age.

AGE-SPECIFIC MORTALITY RATE The number of deaths occurring during a specified period to persons (usually specified by sex) of a specified age or age group, divided by the number of person-years-lived during that period by the persons of that age or age group. When an age-specific mortality rate is calculated for a calendar year, the number of deaths to persons of the specified age is usually divided by the midyear population of persons of that age. Age-specific mortality rates are generally denoted by ${}_nM_x$, the annual death rate to persons aged x to x + n.

AGE STANDARDIZATION A procedure of adjustment of crude rates (birth, death, or other rates) designed to

reduce the effect of differences in age structure when comparing rates for different populations.

BIRTH HISTORY A report of the number and dates of all live births experienced by a particular woman; see also pregnancy history. The sex of each child, the survival of each child to the date of the interview, and, where pertinent, the date of death are also generally recorded.

BIRTH ORDER The ordinal number of a given live birth in relation to all previous live births of the same woman (e.g., 5 is the birth order of the fifth live birth occurring to the same woman).

BIRTH RATE See crude birth rate.

CHANDRASEKARAN-DEMING TECHNIQUE A procedure to estimate the coverage of two independent systems collecting information about demographic or other events, based on the assumption that the probability of an event being recorded by one system is the same whether or not the event is recorded by the other system. The events from both systems are matched to establish M, the number of events recorded by both systems; U_1, the number recorded only by system 1; and U_2, the number recorded only by system 2. The Chandrasekaran-Deming formula then estimates total events, N, as

$$\hat{N} = M + U_1 + U_2 + \frac{U_1 U_2}{M}.$$

CHILDBEARING AGES The span within which women are capable of bearing children, generally taken to be from age 15 to age 49 or, sometimes, to age 44.

CHILDREN EVER BORN(E) The number of children ever borne alive by a particular woman; synonymous with parity. In demographic usage, stillbirths are specifically excluded.

COHORT A group of individuals who experienced the same class of events in the same period. Thus an age cohort is a group of people born during a particular period, and a marriage cohort is a group of people who married during a particular period. The effects of a given set of mortality or fertility rates are often illustrated by applying them to hypothetical cohorts.

COHORT FERTILITY The fertility experienced over time by a group of women or men who form a birth or a marriage cohort. The analysis of cohort fertility is contrasted with that of period fertility.

CRUDE BIRTH RATE The number of births in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as births per 1,000 population. The crude birth rate for a single year is usually calculated as the number of births during the year divided by the midyear population.

CRUDE DEATH RATE The number of deaths in a population during a specified period divided by the number of person-years-lived by the population during the same period. It is frequently expressed as deaths per 1,000 population. The crude death rate for a single year is usually calculated as the number of deaths during the year divided by the midyear population.

CUMULATED FERTILITY An estimate of the average number of children ever borne by women of some age x, obtained by cumulating age-specific fertility rates up to age x; also often calculated for age groups.

DEATH RATE See crude death rate.

DE FACTO POPULATION A population enumerated on the basis of those present at a particular time, including temporary visitors and excluding residents temporarily absent. See de jure population.

DE JURE POPULATION A population enumerated on the basis of normal residence, excluding temporary visitors and including residents temporarily absent. See de facto population.

DIGITAL PREFERENCE See age heaping.

DUAL RECORD SYSTEM See Chandrasekaran-Deming Technique

EXPECTATION OF LIFE AT BIRTH The average number of years that a member of a cohort of births would be expected to live if the cohort were subject to the mortality conditions expressed by a particular set of age-specific mortality rates. Denoted by the symbol e(o) in life table notation.

FERTILITY HISTORY Either a birth history or a pregnancy history.

FORWARD SURVIVAL A procedure for estimating the age distribution at some later date by projecting forward an observed age distribution. The procedure uses survival ratios, often obtained from model life tables. The procedure is basically a form of population projection without the introduction of new entrants (births) to the population.

GENERAL FERTILITY RATE The ratio of the number of live births in a period to the number of person-years-lived by women of childbearing ages during the period. The

general fertility rate for a year is usually calculated as the number of births divided by the number of women of childbearing ages at midyear.

GROSS REPRODUCTION RATE The average number of female children a woman would have if she survived to the end of her childbearing years and if, throughout, she were subject to a given set of age-specific fertility rates and a given sex ratio at birth. This number provides a measure of replacement fertility in the absence of mortality.

GROWTH RATE The increase or decrease of a population in a period divided by the number of person-years-lived by the population during the same period. The increase in a population is the result of a surplus (or deficit) of births over deaths and a surplus (or deficit) of immigrants over emigrants. (The annual increase is often expressed as a fraction of the total population at the beginning of the year, but this convention has the inconvenient characteristic of not being readily defined for a five-year interval and of being unequal to the difference between the birth rate and the death rate even in the absence of migration.) See also rate of natural increase.

INFANT MORTALITY RATE The number of deaths of children under 1 year of age occurring in the same year; also used in a more rigorous sense to mean the number of deaths that would occur under 1 year of age in a life table with a radix of 1,000, in which sense it is denoted by the symbol ${}_1q_0$.

LIFE TABLE A listing of the number of survivors at different ages (up to the highest age attained) in a hypothetical cohort subject from birth to a particular set of age-specific mortality rates. The rates are usually those observed in a given population during a particular period of time. The survivors of the radix to age x are generally denoted by $l(x)$. The tabulations commonly accompanying a life table include other features of the cohort's experience: its expectation of life at each age x, denoted by $e(x)$; the probability of surviving from each age x to age x + n, denoted by ${}_nq_x$; the person-years-lived by the hypothetical cohort as it ages from age x to age x + n, denoted by ${}_nL_x$ (also equivalent to the population aged x, x + n in a stationary population experiencing a number of births each year equal to the radix of the life table); and the person-years-lived

by the hypothetical cohort from age x onward, denoted by T(x).

LOGIT The logit of a proportion p is $1/2 \ln[p/(1 - p)]$. As a linearizing transformation, the logit has been proposed as the basis of a model life table system in which the logit of a probability of dying by age x ($_xq_0$) is related linearly to the logit of a standard probability of dying by age x ($_xq_0^s$) so that

$$\text{logit } (_xq_0) = \alpha + \beta \, [\text{logit } (_xq_0^s)],$$

where α is a measure of mortality level relative to the standard and β is a parameter that alters the shape of the standard mortality function.

MARITAL FERTILITY Any measure of fertility in which the births (in the numerator) are births to married women and in which the number of person-years-lived (in the denominator) also pertains to married women. In some instances, the designation "married" includes persons in consensual unions.

MEDIAN The value associated with the central member of a set that is ordered by size or some other characteristic expressed in numbers.

MEAN AGE OF CHILDBEARING The average age at which a mortality-free cohort of women bear their children according to a set of age-specific fertility rates.

MEAN AGE OF CHILDBEARING IN THE POPULATION The average age of the mothers of the children born in a population during a year. This measure incorporates the effects of both mortality and the age distribution.

MIGRATION RATE Number of migrants during a specified period divided by the person-years-lived of the population exposed to migration. Also see population change due to migration.

MODEL LIFE TABLE An expression of typical mortality experience derived from a group of observed life tables.

MOVING AVERAGES The successive averaging of two or more adjacent values of a series in order to remove sharp fluctuations.

MYERS INDEX An index of digit preference that essentially sums in turn the population ending in each digit over some age range, often 10-89, expressing the total as a percentage of the total population, and which avoids the bias introduced by the fact that the population is not evenly distributed among all ages by

repeating the calculations 10 times, once for each starting digit, and averaging the results. The difference between the average percentage for each digit and the expected value of 10 percent provides a measure of the preference for or avoidance of the digit over the age range considered.

NATURAL FERTILITY The age pattern of marital fertility observed in non-contraceptive populations where reproductive behavior is not affected by the number of children already born.

NET MIGRATION The difference between gross immigration and gross emigration.

NET REPRODUCTION RATE The average number of female children born per woman in a cohort subject to a given set of age-specific fertility rates, a given set of age-specific mortality rates, and a given sex ratio at birth. This rate measures replacement fertility under given conditions of fertility and mortality: it is the ratio of daughters to mothers assuming continuation of the specified conditions of fertility and mortality.

OWN-CHILDREN METHOD A refinement of the reverse-survival procedure for fertility estimation, whereby estimates of age-specific fertility rates for the recent past are obtained by relating mothers to their own children, using information on relationship and other characteristics available from a census or survey.

PARITY See children ever born.

PARTIAL BIRTH RATE The proportion of the population that enters (that is, is "born" into) a given age category in a year. The age categories used are normally open-ended, thus the partial birth rate x+ designates the proportion of the population becoming x years and older.

PARTIAL DEATH RATE The proportion of the population that leaves (that is, "dies" out of) a given age category in a year. See partial birth rate.

PERIOD FERTILITY The fertility experienced during a particular period of time by women from all relevant birth or marriage cohorts; see also cohort fertility.

P/F RATIO METHOD A consistency check for survey information on fertility. Information on recent fertility is cumulated to obtain measures that are equivalent to average parities. Lifetime fertility in the form of reported average parities by age group (P) can then be compared for consistency with the parity-equivalents (F) by calculating the ratio P/F

for successive age groups. If certain assumptions about error patterns are met, an improved estimate of fertility can sometimes be obtained by correcting the age pattern of current fertility to agree with the level of lifetime fertility reported by younger women.

POPULATION CHANGE DUE TO MIGRATION The sum of in-migrants minus out-migrants during a specified period of time. The change may also be expressed as a rate by dividing the change by person-years-lived in the population during the same period.

PREGNANCY HISTORY A report of the number and the dates of occurrence of all the pregnancies experienced by a particular woman. The outcome of the pregnancy--live birth, stillbirth, fetal death--is also recorded.

RADIX The hypothetical birth cohort of a life table. Common values are 1, 1,000, and 100,000.

RATE OF NATURAL INCREASE The difference between the births and deaths occurring during a given period divided by the number of person-years-lived by the population during the same period. This rate, which specifically excludes changes resulting from migration, is the difference between the crude birth rate and the crude death rate.

RETROSPECTIVE SURVEY A survey that obtains information about demographic events that occurred in a given past period, generally terminating at the time of the survey.

REVERSE PROJECTION See reverse survival.

REVERSE SURVIVAL A technique to estimate an earlier population from an observed population, allowing for those members of the population who would have died according to observed or assumed mortality conditions. It is used as a method of estimating fertility by calculating from the observed number of survivors of a given age x the expected number of births that occurred x years earlier. (In situations for which both fertility and mortality are known or can be reliably estimated, reverse survival can be used to estimate migration.)

ROBUSTNESS A characteristic of estimates that are not greatly affected by deviations from the assumptions on which the estimation procedure is based.

SEX RATIO AT BIRTH The number of male births for each female birth, or male births per 100 female births.

SINGULATE MEAN AGE AT MARRIAGE (SMAM) A measure of the mean age at first marriage, derived from a set of proportions of people single at different ages or in

different age groups, usually calculated separately for males and females.

STABLE POPULATION A population exposed for a long time to constant fertility and mortality rates, and closed to migration, establishes a fixed age distribution and constant growth rate characteristic of the vital rates. Such a population, with a constant age structure and constant rate of growth, is called a stable population.

STATIONARY POPULATION A stable population that has a zero growth rate, with constant numbers of births and deaths per year. Its age structure is determined by the mortality rates and is equivalent to the person-years-lived ($_nL_x$) column of a conventional life table.

SURVIVAL RATIO The probability of surviving between one age and another; often computed for age groups, in which case the ratios correspond to those of the person-years-lived function, $_nL_x$, of a life table. Also called survivorship probabilities.

SURVIVORSHIP PROBABILITIES See survival ratio.

SYNTHETIC PARITY The average parity calculated for a hypothetical cohort exposed indefinitely to a set of period age-specific fertility rates.

TOTAL FERTILITY RATE (TFR) The average number of children that would be born per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates; also referred to as total fertility. It is frequently used to compute the consequence of childbearing at the rates currently observed.

UNITED NATIONS AGE-SEX ACCURACY INDEX An index of age reporting accuracy that is based on deviations from the expected regularity of population size and sex ratio, age group by age group. The index is calculated as the sum of (1) the mean absolute deviation from 100 of the age ratios for males, (2) the mean absolute deviation from 100 of the age ratios for females, and (3) three times the mean of the absolute difference in reported sex ratios from one age group to the next. The United Nations defines age-sex data as "accurate," "inaccurate," or "highly inaccurate" depending on whether the index is less than 20, 20 to 40, or greater than 40.

WHIPPLE'S INDEX A measure of the quality of age reporting based on the extent of preference for a particular target digit or digits. The index

essentially compares the reported population at ages ending in the target digit or digits with the population expected on the assumption that population is a linear function of age. For a particular age range, often 23 to 62, the population with ages ending in the target digits is divided by one-tenth of the total population, the result then being multiplied by 100 and divided by the number of different target digits. A value of 100 indicates no preference for those digits, whereas values over 100 indicate positive preference for them.

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5.16

COMMITTEE ON
POPULATION AND DEMOGRAPHY

Report No. 26

Fertility Determinants in Cuba

Paula E. Hollerbach
Sergio Diaz-Briquets

Panel on Fertility Determinants
Committee on Population and Demography
National Research Council

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PREFACE

Fertility and its determinants have been urgent topics for research in recent decades with the rapid expansion in world population. Attempts to control population growth have focused on reducing fertility, with some apparent effect. The peak rate of growth in the world's population has now been passed, but growth is still at a high level in almost all the developing countries. In absolute numbers, the increase in the world's population continues to rise; according to United Nations medium projections, more people will be added each year for the next 50 years than were added in 1980.

This report is one of a series of country studies of fertility determinants carried out by the Panel on Fertility Determinants of the Committee on Population and Demography. The Committee on Population and Demography was established in April 1977 by the National Research Council in response to a request by the Agency for International Development (AID) of the U.S. Department of State.

The causes of the reductions in fertility--whether they are the effect primarily of such general changes as lowered infant mortality, increasing education, urban rather than rural residence, and improving status of women, or of such particular changes as spreading knowledge of and access to efficient methods of contraception or abortion--are strongly debated. There are also divergent views of the appropriate national and international policies on population in the face of these changing trends. The differences in opinion extend to different beliefs and assertions about what the population trends really are in many of the less-developed countries. Because births and deaths are recorded very incompletely in much of Africa, Asia, and Latin America, levels and

trends of fertility and mortality must be estimated, and disagreement has arisen in some instances about the most reliable estimates of those levels and trends.

It was to examine these questions that the committee was established within the Commission on Behavioral and Social Sciences and Education of the National Research Council. It was funded for a period of five and one-half years by AID under Contract No. AID/pha-C-1161 and Grant No. AID/DSPE-G-0061. Chaired by Ansley J. Coale, the committee has undertaken three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;
2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection);
3. To evaluate the factors determining the changes in birth rates in less-developed nations.

Given the magnitude of these tasks, the committee concentrated its initial efforts on the first two tasks. This work is detailed in a series of country and methodological reports from the National Academy Press, and the demographic estimation methodology developed for the country studies is laid out in a volume issued by the United Nations. Altogether, some 170 population specialists, including 94 from developing countries, have been involved in the work of the committee as members of panels or working groups. The committee, the commission, and the National Research Council are grateful for the unpaid time and effort these experts have been willing to give.

The committee initiated work on the third task in October 1979 when the separately funded Panel on Fertility Determinants was established. Research on the determinants of fertility change has been carried out by scholars from several disciplines, and there is no comprehensive accepted theory of fertility change to guide the evaluation. Because of this state of knowledge of the causes of reductions in fertility and the difficulty of the task, the Panel on Fertility Determinants includes scholars from anthropology, demography, economics, epidemiology, psychology, sociology, and statistics. Three committee members serve on the panel. The work program of the panel includes the preparation of a report that attempts to summarize and integrate scientific knowledge about the

determinants of fertility (Academic Press, 1983) as well as a few illustrative cross-national analyses and studies of several developing countries (see inside back cover).

This report is the fifth panel country study. It has been prepared by panel member Paula E. Hollerbach, of the Center for Policy Studies of the Population Council, and Sergio Diaz-Briquets, who was with the Population Reference Bureau when the study was prepared and is currently with BD International. Kenneth H. Hill of the committee staff prepared the technical appendix on demographic estimates.

Much of the work on this study was carried out at the Population Council and at the Population Reference Bureau. The authors spent time at each other's institution and at the panel office. Both of the authors' institutions provided logistical support during the initial preparation of the study, and the Population Council assisted with the preparation of study materials, including computer tabulations and graphs, throughout the study. More importantly, each institution essentially supported each author during the time she and he devoted to the preparation of the report. The panel and the committee are grateful to those institutions for their generous support.

The authors and the panel wish to thank Francisco Rojas Ochoa, Director General of the Cuban Instituto de Desarrollo de la Salud, and Mari S. Simonen, evaluation officer of the Policy and Evaluation Division of the United Nations Fund for Population Activities, for their generous provision of material relating to Cuba demography. In addition, several individuals provided information, data, and suggestions for the study: John Bongaarts, Geoffrey McNicoll, Carmelo Mesa-Lago, Lisandro Perez, Jorge Perez-Lopez, Constantina Safilios-Rothschild, and Ferhunde Ozbay. On staff at the Population Council, Joan Elliott and Robert Sendek prepared the graphics for the study, and Adrienne Lindgren efficently and painstakingly typed the successive versions of the manuscript. Finally, panel and committee reviewers provided advice and suggestions.

An early version of the draft report was discussed at a country studies workshop organized by the panel in January 1982 with financial assistance from the Rockefeller Foundation. The Foundation also supported the costs of printing this report.

Several members of the panel staff assisted in the preparation of this report. Rona Biere edited the report, Elaine McGarraugh applied her eagle eye and production editing talents, and Solveig Padilla assisted with the typing.

W. Parker Mauldin, Chair
Panel on Fertility Determinants

SUMMARY

Cuba, the largest archipelago in the Antilles, was discovered in 1492 by Columbus and was conquered and colonized by 1510 with the founding of towns by Diego Velazquez. After centuries of very slow growth, the population increased more rapidly by the end of the eighteenth and into the nineteenth centuries, primarily because of the expanding sugar and coffee economies, which promoted the importation of slaves and the arrival of free migrants. The birth rate in the nineteenth century is thought to have been around 40 per 1,000, while the death rate was high and fluctuating as a result of recurring epidemic diseases. Most of the population growth from 572,000 in 1817 to 1.6 million in 1899 was due to the immigration of Spaniards and other Europeans and the importation of African slaves and Chinese indentured servants.

The course of the demographic transition in twentieth-century Cuba contrasts sharply with the rapid population growth experienced by other developing countries in the post-World War II period. Cuba, along with Uruguay and Argentina, was among the first Latin American nations to experience a transition to low mortality and fertility. Although reliable statistics for earlier time periods are lacking, the available evidence suggests that mortality began to decline at the beginning of this century and fertility during the 1920s, with the latter declining at a relatively rapid rate during the late 1940s and more gradually in the 1950s. By 1958, the birth rate had declined to 26 and the total fertility rate to 3.6-3.8. Fertility had reached moderate levels in most of the provinces, particularly in the central ones, while remaining high in the lower-income and more rural provinces at the extreme eastern and western ends of the island. A

variety of socioeconomic factors may account for this relatively low fertility. Prerevolutionary Cuba was a highly urbanized, secularized country with a high proportion of European-origin inhabitants, high literacy, well-developed communication and transportation systems, and predominantly large-scale plantation farming that employed seasonal labor. Although organized family planning programs and modern contraceptive methods were unavailable, reliance on traditional methods of contraception (condom, withdrawal, rhythm, and douche) also helped to achieve the comparatively low fertility; moreover, while illegal in theory, abortions were openly performed by physicians, as well as by less-skilled and lower-cost practitioners, and were available throughout the country, especially in Havana.

Infant mortality began to decrease even before the reductions in fertility occurred; it fell more sharply after 1925, just after fertility began to decline, and by the early 1950s had dropped to 60. Prior to the revolution, Cuba's medical system was highly developed through mutualist insurance plans and a fairly extensive system of public hospitals and dispensaries, accounting in part for the low infant mortality and high life expectancy achieved by the population.

Thus by 1958, the year prior to the Cuban revolution, Cuba's demographic profile was one of the developing world's most advanced. There was a postrevolutionary baby boom (1959-64) during which the crude birth rate rose from 28 per 1,000 population to 35. Thereafter, fertility declined slowly until 1973, when the crude birth rate finally reached its prerevolutionary level. Trends in fertility from 1973 to 1981 were particularly striking: the crude birth rate declined from 25 in 1973 to 14 in 1981, giving Cuba the lowest birth rate in Latin America. Further examination of trends in total fertility in the immediate pre- and postrevolutionary period shows that the total fertility rate increased from 3.8 in the late 1950s to 4.7 in 1960-65, and subsequently declined in the latter 1960s to 4.3. By 1970-75, the total fertility rate had finally fallen below prerevolutionary levels (3.5 according to Cuban figures), and by 1981 had reached 1.6, well below replacement level.

Estimates suggest that the postrevolutionary baby boom occurred among all age groups, but resulted primarily from a shift toward earlier childbearing and higher fertility among younger women, especially those aged 15-19 and 20-24. The subsequent decline in the late

1960s can be attributed primarily to lower marital fertility, mainly among women age 25 and above. By 1979, all age groups had experienced fertility declines, with 20-29 as the primary reproductive period.

Concurrent with fertility decline, emigration from Cuba over the past 22 years has further reduced population growth rates. Cuba's postrevolutionary baby boom was partially offset by emigration, which reached an early peak between 1960 and 1962 and was interrupted in late 1962 by the missile crisis. A subsequent wave of emigration from late 1965 to 1972 resulted from an agreement between the U.S. and Cuban governments. The latest surge of emigration occurred in 1980 with the Mariel small-boat evacuation.

Figures on Cuban emigration differ somewhat depending on the source. Between January 1, 1959, and September 20, 1980, nearly 800,000 Cubans are known to have entered the United States; this represents 8 percent of the country's population in 1981 (approximately 9.7 million). Estimates of the Cuban-born population and their descendants residing in the United States, based on U.S. census data, indicate that about 700,000 Cubans and their descendants were living in the United States by the late 1970s. Official Cuban figures on net international migration show a net loss (emigrants minus immigrants) of 599,012 persons between 1959 and 1979. It could be hypothesized that the fertility rise in the 1960s would have been even more pronounced in the absence of sex-imbalanced emigration, since the imbalance was concentrated in the peak years of family formation. However, while the data available to test this proposition are extremely limited, they do not suggest that the absence of emigration would have significantly changed the sex ratios of the population of childbearing age.

Data on the expected number of children gathered in the 1979 National Demographic Survey reflect Cuba's recent fertility decline and indicate a continuation of low fertility, at least for the immediate future. Among women aged 15-19 in union, the mean expected family size was only 1.5 children; among those aged 20-24, the expected family size was about 2 children. In comparison, the total fertility rate at that time was 1.8. Among women in union aged 40-44, who were completing their childbearing, the mean number of children was considerably higher--approximately 3.8.

A contraction in rural-urban, provincial, and socioeconomic differentials accompanied the rapid fertility

decline. Between 1965 and 1977, declines were particularly sharp in rural areas, and by 1977, rural-urban differentials in fertility had been considerably reduced (TFR of 2.1 in urban and 2.7 in rural areas). In Oriente and Pinar del Rio, characterized by a higher proportion of rural population, the decline in total fertility was steady and uninterrupted. In the other provinces, all of which were more urbanized and of lower fertility, some stabilization and slight increases in fertility were recorded in the early 1970s, with fertility descending again in 1973. By 1977, the largest provincial differentials in total fertility had been considerably reduced (2.6 in Oriente and 1.9 in La Habana). By 1980, fertility differentials by province had contracted even further. Similarly, the decline in total fertility rates occurred within all occupational categories, though it was especially sharp among agricultural workers. By the late 1970s, there was comparatively little difference in fertility by occupational category, with the exception of agricultural laborers, particularly those whose wives had fewer than 3 years of education. With respect to educational differentials, from 1965 to 1977, the sharpest reductions in fertility occurred among women with less than primary-school education, especially among those with fewer than 3 years of schooling completed. Among better-educated women, fertility increased somewhat during the early 1970s and then continued to decline after 1972. By 1977, women with lower-intermediate, upper-intermediate, and university educations had achieved below-replacement-level fertility.

Decomposition of the crude birth rate and general fertility rate for the 1970-79 period indicates that most of the fertility decline during the decade resulted from lower marital fertility due to increased use of fertility regulation, with a less significant contribution from a decline in the proportion of women in reproductive unions. Counteracting these tendencies to a small degree was an increase in the number of women of reproductive age, due to the arrival at these ages of the cohorts born during the early years of the 1960s baby boom.

A variety of factors have been suggested as influencing Cuba's fertility over the past two decades. The available evidence suggests that the baby boom, occurring primarily in the more urbanized provinces, coincided with other changes: government policies pertaining to housing costs, minimum salaries, and the expansion of social services, especially in rural health and education,

sharply reduced the cost of living and contributed to a redistribution of personal income benefiting the poor and middle classes; there was a rise in marriage rates and in the proportion of women in union; and abortion and contraception were less available because of more rigorous enforcement of the anti-abortion law and a shortage of contraceptive supplies following the economic blockade of Cuba.

Identifying the socioeconomic determinants of the ensuing fertility decline, beginning in 1965 and especially rapid since 1973, is more problematic. A variety of contributing factors can be identified: declining infant and child mortality; a reduction in the economic value of children in the poorer rural provinces through policies achieving nearly full male employment, universal social security and pension provisions, compulsory primary school education, and age restrictions on the employable population; a rise in the educational attainment of women through the expansion of primary- and secondary-school enrollments and adult education programs; the changing status of women and increasing female labor force participation; recent price increases for services and the high prices charged in parallel and black markets, in conjunction with stabilization and probable reversals in income differentials; the Cuban housing shortage, especially acute in urban areas; a recent rise in the age at marriage; the widespread availability of abortion since the mid-1960s; and the diffusion of modern contraceptives, especially since the mid-1970s.

Because socioeconomic changes since the revolution have been concomitant with accelerated fertility decline, it is extremely difficult to discern which factors are most significant. In the present study, it was found that among the proximate determinants of fertility, decomposed for the 1970-73 period, the effect of contraception is the most significant, followed by the effect of nuptiality; the fertility-inhibiting effects of these two factors are significantly greater than the effect of abortion. Postpartum infecundability is least significant, and is therefore excluded from the discussion that follows. The sections below examine the primary proximate determinants of Cuba's fertility decline--contraception, nuptiality, and abortion--and then focus on the socioeconomic determinants.

CONTRACEPTION

Contraception was not emphasized by the Cuban government until the mid-1970s because of the priority assigned to other needs within the health system. Moreover, although modern contraceptive methods, especially intrauterine devices and sterilization, were available in Cuba during the early 1960s, their quantities were somewhat limited. Contraception was provided in public health facilities on request or upon recommendation by a physician following abortion.

No contraceptive prevalence surveys are available at the national level, and the actual mix of methods is not known. However, contraception is the major method of fertility regulation in Cuba, and all methods are currently available. Early fertility surveys conducted in selected urban and rural areas of Cuba during 1970-73 show that the highest levels of past use were recorded for the intrauterine device and the condom, with sterilization most frequently used by women age 35 and above. In the early 1970s, approximately 35 percent of all women of reproductive age in the rural area surveyed and 54 to 64 percent in urban areas reported that they were currently using some method of contraception. Considerably smaller proportions of women (25-34 percent in the urban areas and 22 percent in the rural areas) were currently using an effective method (intrauterine device, sterilization, diaphragm, or pill). At the national level, it is estimated that 53 percent of all married women of reproductive age were using contraception in 1972.

Since the mid-1970s, the provision of contraceptive services has been facilitated by the assistance of various international agencies, including the United Nations Fund for Population Activities and the International Planned Parenthood Federation. These agencies have provided equipment for obstetrical/gynecological procedures and pregnancy termination, contraceptive supplies, and training fellowships. Presentations and discussions concerning pregnancy, sexuality, breastfeeding, nutrition, pre- and postpartum care, and family planning are provided at meetings of the Committees for the Defense of the Revolution and the Federation of Cuban Women. Some information is also provided by the press, radio, and television, and through sex education in the national school system. However, the major source of information is the classes in family planning, preparation

for childbirth, and infant care conducted in polyclinics and maternity homes.

A more recent fertility survey conducted in 1980 in Havana indicates that substantially higher proportions of women in union were then using contraception. Among these women, 68 percent were current users, while 60 percent were using the three most effective methods--intrauterine device, sterilization, and, to a lesser extent, the pill. At the national level, it is estimated that 79 percent of all married women of reproductive age were using contraception in 1980.

On the basis of these limited data, it appears that Cuba's relatively low prerevolutionary birth rate was achieved through use of less effective contraceptive methods and abortion. In the immediate postrevolutionary period, a decline in the prevalence and practice of both was partially responsible for the upturn in the birth rate, followed by a return to the previous pattern by the early 1970s. By 1980, the increased availability of government-supplied contraceptives (primarily the pill, the intrauterine device, and sterilization) had resulted in reduced reliance on less effective methods, higher contraceptive prevalence, and greater access to contraceptive services, especially in the less developed provinces, as well as a decline in the incidence of abortion.

NUPTIALITY

From 1953 to 1970, trends in marital status for Cuban males and females aged 15-49 show a decline in the proportions single and an increase in the proportions in union. During this period, especially the immediate postrevolutionary years 1960-63, both the singulate mean age at marriage and the mean age at legal marriage declined and total marriage rates rose. To illustrate, between 1953 and 1970, the singulate mean age at marriage declined approximately 2.5 years for both males and females. By 1970, the singulate mean age at marriage was 23.4 years for males and 19.5 years for females. By 1971, the last year of published data, the mean age at legal marriage was 26.1 years for women and 30.3 years for men. By 1970, 56 percent of all men and 68 percent of all women of reproductive age were in union, in comparison to 50 percent of all men and 62 percent of all women of reproductive age in 1953. These trends toward

earlier marriage seem attributable to the redistribution of income; a reduction in the cost of living, especially in health, education, and housing; and increased economic security due to higher employment rates.

Between 1970 and 1979, however, a trend toward postponement of union was evident. The mean age at marriage for males increased .5 years from 23.4 to 23.9, and for females .7 years from 19.5 to 20.2. Differences in the mean age at marriage for men and women narrowed slightly. Although the number of men and women entering reproductive age increased with the aging of the baby boom cohort, the proportion of the population aged 15-49 currently in union declined somewhat to 65 percent of women and 56 percent of men in 1979. The trend toward postponement of marriage in the late 1970s and an increase in the proportion of single women among those aged 15-19 is probably partially attributable to the expansion of secondary education, the housing shortage in urban areas, and the effect of a marriage squeeze, that is, a shortage of males aged 20-24 for females aged 15-19 (due to the aging of the baby boom cohort and the effect of Cuban military and civilian activities abroad). The impact of this marriage squeeze on nuptiality and fertility was further intensified by the 1980 Mariel sealift, during which 125,000 Cubans, predominantly males, emigrated. These shifts in marriage patterns underlie the decline in age-specific fertility recorded among women aged 15-19 and 20-24 during the latter part of the decade.

Government campaigns have been undertaken to encourage the legalization of consensual unions. Although the proportion of women living in consensual union has decreased somewhat in all age groups, 21 percent of women of reproductive age reported living in consensual union in 1979, in comparison to 25 percent in 1970. The prevalence of consensual union is higher in rural than in urban areas; as in other Latin American countries, women in these unions are less educated and begin their unions at younger ages than women in legal unions. They also have higher fertility and fertility expectations than women in legal unions. However, these fertility differentials are greatest among those with the least education (incomplete primary); within other educational categories, fertility differentials by marital status are negligible.

INDUCED ABORTION

Prior to 1959, abortion in Cuba was highly restricted legally, prohibited except on grounds of grave danger to the woman's life or health, on juridical grounds, or on eugenic grounds. However, the conditions constituting high risk to a woman's health were not defined by the law, but merely required the concurrence of two physicians. Abortion was thus available, especially in Havana, where physicians charged moderate fees according to the social class of their patients. From 1959 to 1964, however, the anti-abortion law was more vigorously enforced. Contraceptive practice in Cuba during this period lagged behind that in some other Latin American nations, and a shortage of contraceptive supplies also developed following the economic blockade of Cuba. As a result, the incidence of illegal abortion increased, and between 1962 and 1965, clandestine abortion accounted for nearly one-third of all maternal deaths.

In late 1964, the Social Defense Code was amended to make the conditions for abortion more flexible by adopting the World Health Organization definition of health--a state of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity. These criteria have resulted in greater access to abortion. Under the new penal code of November 1, 1979, punishment has been established for illegal abortions, that is, those performed without the permission of the woman, for profit, outside hospitals, or against the regulations established by the Ministry of Public Health. Increasing access to legal abortion has sharply reduced the incidence of illegal abortions, and has also reduced the number of deaths and death rates associated with abortion. In turn, the reduction in the incidence of illegal procedures has been accompanied by an increase in the incidence of legal abortion.

It is probable that in the early period following abortion liberalization, abortion was used primarily by higher-parity women to prevent unwanted births. Educational efforts were originally directed at high-parity women, and in 1968, only 10 percent of all known pregnancies (excluding spontaneous and illegal induced abortions) were terminated through legal abortion. The legal abortion rate per 1,000 women aged 15-44 rose from 17 in 1968 to 70 in 1974; expressed as a total abortion rate (the average number of abortions per woman during her lifetime at prevailing incidence levels), there was

an increase from .5 abortions per woman in 1968 to 2.1 abortions in 1974. In the early 1970s, the rise in the legal abortion rate was probably associated with increased availability of abortion services and a relaxation of use or method failure associated with traditional contraceptive methods. After 1974, largely because of the greater availability of effective contraceptives, the abortion rate declined to an estimated 47 in 1980, or 1.4 abortions per woman. However, the abortion ratio showed substantial and consistent annual increases throughout the decade as fertility dropped precipitously: from 103 in 1968, the ratio rose to 432 per 1,000 pregnancies in 1979; by 1979, 40 percent of all known pregnancies were terminated by abortion. This increase may be attributable to current low fertility desires and reliance on abortion in preference to contraception or in situations of contraceptive failure.

SOCIOECONOMIC DETERMINANTS OF FERTILITY

The factors influencing Cuba's fertility decline are difficult to disentangle. Although empirical data on various government policies and socioeconomic determinants are abundant, direct evidence linking these variables and fertility is generally quite limited, and inferences must be drawn from the available data. Some judgments can be made, however, on those factors which seem to be most important.

The decline in infant mortality, especially rapid since 1972, appears to be especially significant. This decline is traceable not only to a reduction in mortality from acute diarrheal and infectious and parasitic disease, but also to the national plan for maternal-infant care initiated in 1969. Under this plan, government targets for infant and child mortality reduction have been largely met; substantial progress has also been made in efforts to reduce maternal mortality. On the programmatic level, the number of physicians, specialists, and facilities has been increased to ensure better coverage for prenatal, infant, and pediatric care, especially in the less developed regions.

Although Cuban fertility had already begun to decline in the early 1920s, earlier than in most of Latin America, it is doubtful that the recent rapid decline in Cuban fertility, especially among less-educated and rural women, could have occurred without the establishment of rural

health services to compensate for the previous concentration of services within urban areas, especially Havana. Other components of the maternal-infant care program include early pregnancy detection and monitoring high-risk pregnancies; hospital deliveries of nearly all births; neonatal services to treat newborns with low birthweights and various pathologies; the expansion of pre- and postpartum maternal and infant care through polyclinics; and improvements in rural sanitation.

As a result, since 1969, infant mortality has declined from 47 deaths per 1,000 live births to a provisional official rate of 18.5 in 1981, the lowest infant mortality rate in Latin America. Estimates calculated for the present study, based on analysis of the 1979 National Demographic Survey, do not corroborate the rapid decline in infant mortality since the mid-1970s; however, on grounds of statistical consistency, the decline should be accepted as probably correct. Infant mortality rates have declined in all regions and provinces in the country. Moreover, by 1980, differentials among provinces had been considerably narrowed: infant mortality rates in that year varied from a low of 14 in Matanzas to a high of 24 in Guantanamo province; these narrowed differentials reflect the same distribution as that previously discussed for fertility differentials. In turn, efforts to reduce mortality have lowered fertility: medical personnel have discouraged high-risk pregnancies and births among older women, while individuals have perceptions of higher child survival that reduce the demand for greater numbers of children as "insurance" against child mortality. Given Cuba's current low level of infant mortality, especially in the rural areas, fear of infant and child mortality should no longer influence fertility decisions.

In addition to these efforts promoting improved health care, policies ensuring economic security have probably reduced the economic value of children as sources of labor and old age security, especially in the less developed rural provinces such as Oriente and Pinar del Rio. These policies include nearly full male employment, age restrictions on employment, wage indexing and unemployment insurance, universal social security and pension benefits, the provision of basic needs through the rationing of food and clothing, and free health care and compulsory primary-school education. Data on fertility and the occupational status of the head of household show a sharp reduction in fertility differentials over time between 1964-66 and

1976-78, with the sharpest fertility decline among agricultural workers.

At the same time, other economic policies have contributed to fertility decline by increasing the economic pressures on families. Wage and pricing policies of the 1970s, designed to raise labor productivity, have increased the cost of living over levels of the 1960s. Basic food and clothing needs are met through the rationing system and state-subsidized prices for necessities sold in stores; however, since the early 1970s, the government has begun to charge for utilities and services formerly provided free and has set high prices for scarce consumer goods in the parallel markets established in 1973. These policies, in conjunction with stabilization and probable reversals in income differentials since 1973, have reduced levels of real income over levels of the 1960s for those earning less than average wages. These economic factors seem implicated in fertility decline, although the available empirical data to confirm the association are extremely limited.

Further, improvements in educational attainment have been achieved through compulsory primary-school education for children aged 6-12; expanded secondary-school enrollments, assisted by government grants, which have benefited younger cohorts of women; and adult educational programs for the attainment of primary- and secondary-school education. By 1979, the government goal of 6 years of primary schooling as a national norm had not yet been attained. However, from 1965 to 1977, the sharpest reduction in fertility occurred among women with less than primary-school education, especially among those with less than 3 years of schooling completed. Among better-educated women, fertility increased somewhat during the early 1970s and then continued to decline. After 1972, fertility declined more sharply among these women, and by 1977, those with lower-intermediate, upper-intermediate, and university educations had achieved below-replacement-level fertility.

Another factor contributing to Cuba's fertility decline is government efforts to increase the economic participation of women through adult education, political mobilization and volunteer work, and, more recently during the 1970s, higher rates of female labor force participation. These efforts have provided alternative nonfamilial roles for women and increased the opportunity costs of childbearing. However, despite recent efforts to improve the availability of child care, female employment still

entails considerable time constraints on domestic activities, as evidenced by various Cuban time-budget surveys. The available data suggest that the majority of new entrants into the labor force between 1970 and 1979, primarily women in union, began employment following the peak years of childbearing, but it is not known whether there are fertility differentials between employed and nonemployed women. The impact on fertility of other government policies designed to promote egalitarian attitudes through statutory changes is simply unknown.

A final factor associated with fertility decline, especially in urban areas, is a housing shortage. Limited government investment in housing construction has exacerbated this longstanding problem. Because of government investments in health, education, and the economic infrastructure, little housing was constructed between 1959 and 1971. Although emigration has eased the housing shortage and construction has accelerated since 1972, accumulated housing needs have still not been met, especially given the population growth spurt of the early 1960s and deterioration of the current housing stock. The estimated deficit as of the late 1970s was approximately 1.5 million units, and about 22 percent of the Cuban population is classified as living in substandard housing. The shortage appears particularly significant for the baby boom cohort, which is now entering the age of household formation. Data available to examine the impact of the housing shortage on postponement of marriage and the delay or limitation of childbearing are limited to a few small-scale surveys of residents of Havana. However, the rise in marriage rates during periods of heavy emigration suggests that the scarcity of housing delays the age at marriage or limits family size, at least in urban areas, until times when the existing housing stock can be redistributed. The interruption of the fertility decline in the early 1970s, which occurred almost exclusively in the urban areas, may also be associated with the redistribution of housing during this period of emigration.

The combined influence of these societal and programmatic factors on recent declines in Cuban fertility and mortality is particularly marked. In general, factors associated with social change have resulted in lower mortality and reduced economic utility of children and therefore in reduced fertility desires. Although Cuban fertility would undoubtedly have continued to decline even in the absence of programmatic factors, the sharp

decline in fertility among less educated and rural women probably could not have been achieved without government efforts to improve the availability of fertility regulation and reduce infant mortality. Unique features of the Cuban context, such as its strong national health policy, resources devoted to the expansion of physician-oriented health care, employment and pricing policies, and the urban housing shortage, serve to distinguish Cuba from other developing nations. Thus, Cuba has achieved below-replacement-level fertility in part through a combination of factors unique among developing nations.

CHAPTER 1

INTRODUCTION

BACKGROUND

The Republic of Cuba, the largest archipelago in the Antilles, consists of the island of Cuba and several hundred small islands and keys, the largest being Isla de la Juventud. At nearly 111,000 square kilometers, Cuba is the largest Caribbean country; it is also the most populous, with approximately 9.7 million people in 1981.

Discovered by Columbus in 1492, Cuba was conquered and colonized at the end of 1510 with the founding of towns by Diego Velazquez. After centuries of very slow population growth, the pace of population increase quickened by the end of the eighteenth century and throughout the first three-quarters of the nineteenth century as the expanding sugar and coffee economies promoted the importation of African slaves and the arrival of free migrants. Despite very high mortality, population growth during this period was rapid, with the population doubling every 30 years or so (see Table 1). By 1730, about 100,000 people lived in Cuba, a figure close to the number of original inhabitants at the time of discovery (Centro de Estudios Demograficos, 1976); by 1841, slightly over a century later, Cuba's population exceeded one million. The birth rate in the nineteenth century is thought to have been around 40 per 1,000, while the death rate was high and fluctuating as a result of frequent epidemic diseases.

In 1898, Cuba was the last American nation, along with Puerto Rico, to sever colonial ties with Spain after three decades of periodic warfare against colonial rule. Following the Spanish-American War and a U.S. occupation of just over 3 years, the new republic was declared officially independent in 1902, although under the economic and political tutelage of the United States.

TABLE 1 Colonial Population Growth, 1774-1899: Cuba

Census Year	Enumerated Population	Annual Intercensal Growth Rate
1774	171,620	--
1792	272,300	2.6
1817	572,363	3.0
1827	704,487	2.1
1841	1,007,624	2.5
1861	1,396,530	1.6
1877	1,509,291	.5
1887	1,631,687	.8
1899	1,572,797	-.3

Source: Cuban historical censuses. See also Comite Estatal de Estadisticas (1980).

The following decades of close and often turbulent U.S.-Cuban relations laid the groundwork for the conflicts that have existed between the two countries since January 1, 1959, when Fulgencio Batista's dictatorship ended and the revolutionary movement led by Fidel Castro assumed power in what was to become the first socialist nation in the Western Hemisphere.

Along with, and partly as a result of, this new political and economic order, Cuba has experienced some notable demographic changes during the past two decades. At the same time, its demographic transition has continued. Cuba, along with Uruguay and Argentina, was among the first of the Latin American nations to experience a sustained transition to low mortality and fertility: mortality began to decline at the beginning of this century and fertility during the 1920s. The crude birth rate, which remained at more than 40 per 1,000 throughout the early part of this century, fell steadily after the 1920s, with a relatively rapid decline during the late 1940s and a more gradual fall in the 1950s; by 1958, it had reached 26 per 1,000. Infant mortality, which had begun to decrease even before this drop in fertility, declined more sharply after 1925, just after the fertility decline began, and by the early 1950s had fallen to 60.

Since 1959, a postrevolutionary baby boom, peaking in 1963-64, has been followed by a slow, persistent decline in fertility from 1965 to 1972 and dramatic declines in national crude birth rates from 1973 to 1981: the general fertility rate declined from 163 births per 1,000 women aged 15-44 in 1965 to 60 births in 1981, giving Cuba the lowest birth rate in Latin America; the crude birth rate in 1965 (34) declined 59 percent to an extremely low rate of 14 births by 1981. A narrowing of provincial, rural-urban, and socioeconomic differentials in fertility accompanied this decline. Trends in postrevolutionary mortality show a continuous increase in life expectancy, largely attributable to reductions in infant mortality, especially neonatal and postneonatal. According to official figures, after a period during which infant mortality showed little general trend in the late 1960s (39.7 per 1,000 live births in 1965, 38.8 in 1970); the 1970s saw a period of sharp decline with a 1981 provisional figure of 18.5 deaths. Survey evidence, while supporting official infant mortality figures for the 1960s and early 1970s, fails to confirm the rapid decline in the late 1970s. The 1979 Cuban National Demographic Survey suggests an infant mortality rate around 35 for 1976-77, which, if correct, indicates a substantial underreporting of infant deaths in the official figures for recent years. However, in the absence of internal evidence to suggest a marked worsening of infant death registration in the late 1970s, we prefer to accept the official figures over the indirect estimates from the 1979 survey.

The Cuban mortality figures, based on death registration data, suggest that by the late 1970s, Cuba had attained the lowest infant mortality rate and highest life expectancy at birth among all Latin American countries, followed closely by Uruguay, Costa Rica, Jamaica, and Panama. The latest declines in fertility in conjunction with the stabilizing of mortality levels at a low of 5.6-5.8 deaths per 1,000 resulted in declining crude rates of natural increase from 19.4 in 1973 to 8.4 by 1980.

PURPOSE OF THIS STUDY

Cuba's declining growth rate contrasts sharply with the rapid population growth experienced by other developing nations in the post-World War II period as a result of declining mortality and high fertility. The course of

Cuba's postrevolutionary demographic change may well be an outcome of its distinctive demographic history, as well as its equally distinctive contemporary government policies. Studying Cuba's population is therefore significant, not so much because of its size, but because of these distinctive historical and political elements. Disentangling the fertility effects of various antecedents is a difficult task; however, the Cuban case, one of particular demographic interest, seems comparatively well documented. This study focuses on Cuba's postrevolutionary fertility trends, attempting to trace some of their determinants and possible consequences. Trends in mortality and immigration are also briefly discussed, especially as they affect fertility.

STRUCTURE OF THIS STUDY

This study first reviews Cuba's prerevolutionary demographic trends (Chapter 2). This is followed by a discussion of postrevolutionary trends--general, age-specific, provincial, and rural-urban--concluding with an examination of fertility desires that provides insight on future trends. Chapter 3 enumerates the proximate determinants of fertility in Cuba. First it examines several topics related to nuptiality: trends in age at marriage and marital status; the effects of cohort size, emigration, and civilian and military overseas activities; and decomposition of the change in birth rates, 1970-79. Next it reviews breastfeeding patterns. Finally, it focuses on fertility regulation: governmental policies; contraceptive prevalence; and access to abortion in connection with declines in fertility and abortion-related mortality. The chapter ends with a decomposition of the proximate determinants of fertility. In Chapter 4, the determinants of Cuban fertility are reviewed within two broad categories: economic policies and patterns (aggregate economic growth, income distribution, levels of material consumption, old age security, male and female employment, and time constraints); and social policies and patterns (education, delivery of health services, the decline in infant mortality, and housing). The chapters of the report are followed by appendices that enumerate and evaluate relevant data sources.

As noted in greater detail in the appendices, this study has relied almost exclusively on the use of secondary materials, analysis of 1953 and 1970 Cuban

census data, preliminary results of the 1981 census, annual vital statistics, and basic tabulations from the 1979 National Demographic Survey. These data, although clearly indicating trends in pre- and postrevolutionary fertility and mortality at the national and provincial level, provide only limited understanding of the factors underlying geographic and socioeconomic differentials in fertility for the 1970s. To supplement these statistics, various secondary sources pertaining to Cuban economic and social policies and patterns are incorporated into the text. These data, based on Cuban and non-Cuban sources, are rarely linked directly to fertility. However, they provide information on Cuba's socioeconomic and historical context and indirect evidence on the determinants of fertility behavior and are therefore crucial to an understanding of Cuban demographic history.

CHAPTER 2

DEMOGRAPHIC TRENDS

PREREVOLUTIONARY DEMOGRAPHIC TRENDS

Beginning in the early 1920s and ending in 1958, fertility declined consistently in Cuba, relatively rapidly through the late 1940s and more gradually through the 1950s. Estimates provided in Table 2 show a decline in the crude birth rate from 38 in 1920-24 to 28 births by the early 1950s. Estimated age-specific fertility rates, shown in Table 3 and Figure 1 for the Cuban census years from 1907 through 1953, provide greater detail on the fertility decline. Throughout the period, fertility was highest among women in their twenties. Prior to 1930, age-specific fertility rates among this group were approximately 300 births per 1,000 women per year, and the total fertility rate was consistently high; Cuban women were having an average of almost six children by the time they had completed their childbearing. By 1953, the number of births and the fertility rate among this group had declined by approximately one-third. By 1955-59, the five-year period prior to the revolution, the birth rate had declined to 27 (Comite Estatal de Estadisticas, 1980). In 1958, Cuba's total population size was estimated at approximately 6.8 million.

Immigration has also played a central role in population growth throughout most of Cuba's history. During the nineteenth century, when mortality was still very high, most of the population growth from 572,000 in 1817 to 1.6 million in 1899 was due to the immigration of Spaniards and other Europeans and the importation of African slaves and Chinese indentured servants (Thomas, 1971). As shown in Table 4, between the early 1900s and late 1920s, net international migration added approximately 600,000 people to the country's population.

TABLE 2 Estimated Measures of Fertility, 1899-1959: Cuba

Period	Crude Birth Rate		Total Fertility Rate (TFR)	Gross Reproduction Rate (GRR)	Net Reproduction Rate
1899	32.8		4.01	1.94	1.06
1900-04	42.0				
1905-09	47.6	(1907)	5.82	2.81	1.56
1910-14	43.6				
1915-19	40.4	(1919)	5.78	2.81	1.65
1920-24	37.8				
1925-29	35.9				
1930-34	34.6	(1931)	4.50	2.18	1.40
1935-39	33.8				
1940-44	33.4	(1943)	4.00	1.92	1.38
1945-49[a]	32.1				
1950-54[a]	29.7		4.01	1.95	1.64
1955-59	26.6		3.76	1.83	1.58

[a]Official figures overestimate fertility according to calculations undertaken for this report.

Sources: 1899-1949 figures: Catasus Cervera et al. (1975). GRR 1950-54: Comite Estatal de Estadisticas (1980). GRR 1955-59: JUCEPLAN, D.C.E. (1978). TFR 1950-59: Comite Estatal de Estadisticas (1980).

Spanish immigration predominated during the early 1900s, with a significant proportion of Haitian and Jamaican, other European, and American immigrants from 1914 to 1920.[1]

The wave of immigration was directly related to the expansion of the sugar industry, which lasted until the 1920s and was produced by large-scale foreign investments, mainly by the United States. However, as the depression of the 1930s set in, the decline in Cuba's economy caused male workers to return to their country of origin; during the 1930s, there was a net emigration estimated at nearly 130,000 (Collver, 1965). The onset of Cuba's fertility decline was perhaps a response to this economic crisis. Decomposition of the birth rate is impossible for the 1930s because of deficiencies in the early census data (see Appendix 2). However, as noted in Table 4, the sex ratios recorded in all Cuban censuses in the early 1900s are high, skewed toward male dominance. After 1931 the sex ratio begins to decline, reflecting the change from

TABLE 3 Age-Specific Fertility Rates for Five-Year Age Groups, and Total Fertility Rate per Woman in the Years of the Cuban Census, 1907-53: Cuba

Year	Age Group 15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total Fertility Rate
1907	122.4	305.3	301.4	224.9	146.2	54.4	9.3	5.82
1919	120.1	304.5	301.5	223.7	144.3	53.6	9.3	5.79
1931	85.1	246.6	242.8	173.7	106.7	39.3	6.3	4.50
1943	72.9	222.4	218.1	154.2	92.8	34.2	5.5	4.00
1953	58.9	205.7	203.7	139.0	79.1	28.8	4.2	3.60

Source: Catasus Cervera et al. (1975).

male-dominated immigration to male-dominated emigration and subsequently little net migration.

Aside from shifts in the age and sex composition of the population, the availability of abortion may have been an additional factor in this early fertility decline. Although the abortion law placed restrictions on availability, these were not strictly upheld in practice. Writing on the problem of abortion, Chelala-Aguilera reported an estimated 15 abortions for every 100 births between 1934 and 1936 in the Maternity Hospital of Havana; the extent of clandestine abortion was roughly estimated as 10,600 per year (Gonzalez Perez, n.d.).

Provincial data on fertility prior to the revolution (appearing later in Table 10) show that provincial crude birth rates declined about three to four points in all provinces between 1953 and 1958, except in La Habana where fertility remained constant. Prior to the revolution, low to moderately low fertility characterized most provinces. By 1958, fertility was lowest (20-22) in the provinces of La Habana and Matanzas and at moderately low levels of 23-26 in Las Villas and Camaguey provinces. Somewhat higher fertility characterized the provinces in the extreme east and west of the island (Pinar del Rio and Oriente) where a sizeable 39 percent of the 1953 population resided; there the crude birth rates for 1958 were estimated as 28 and 34, respectively (Gonzalez et al., 1978).

A variety of socioeconomic factors may be related to low fertility in the central provinces during the 1940s and 1950s. Prerevolutionary Cuba was a highly urbanized,

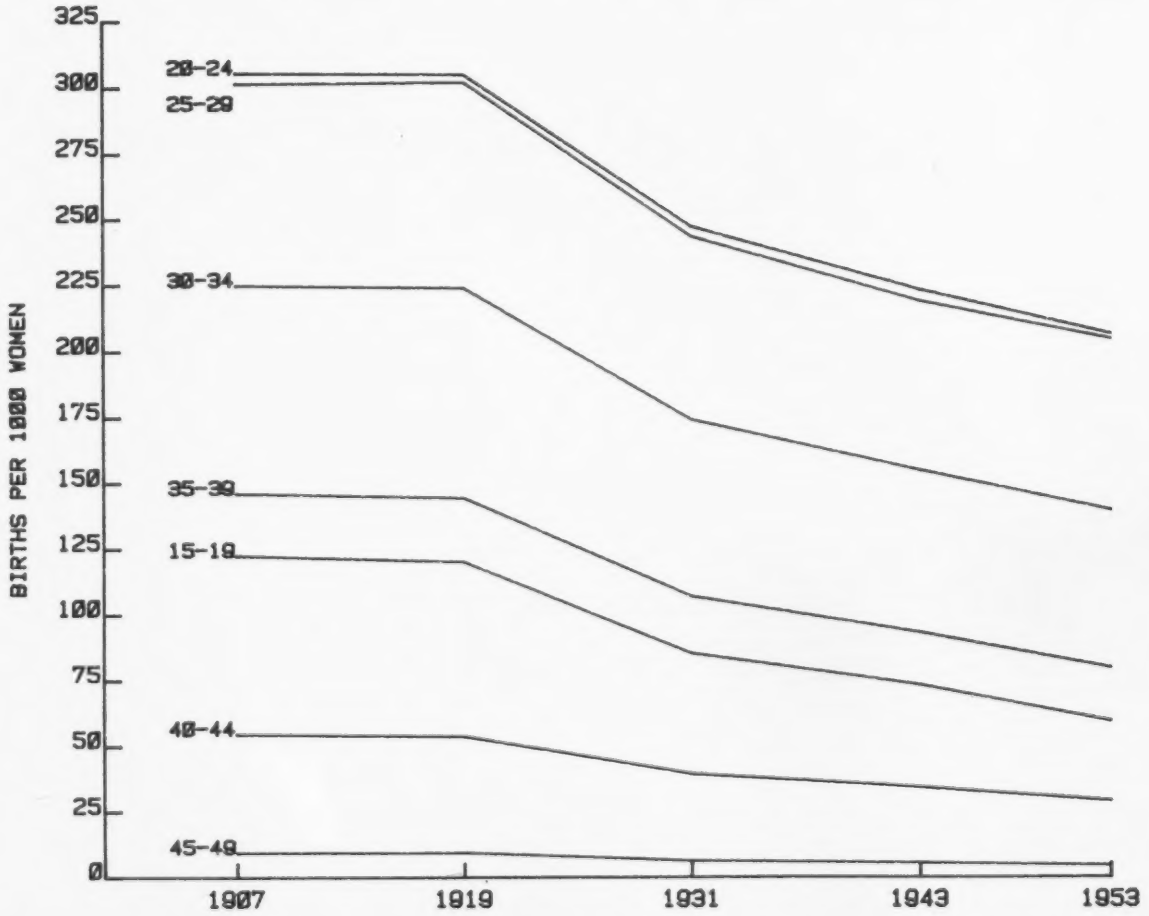

FIGURE 1 Age-Specific Fertility Rates for Five-Year Age Groups, Census Years, 1907-53: Cuba

TABLE 4 Demographic Indicators and Population Growth, 1899-1981: Cuba

Census Year	Enumerated Population	Annual Intercensal Growth Rate (percent)	Percent Urban	Sex Ratio[a]	Population Density[b]	Net International Migration
1899	1,572,797	--	47.1	107.6	13.7	
1907	2,048,980	3.3	43.9	110.3	17.9	127,357 (1900-1909)
1919	2,889,004	2.9	44.7	112.7	25.2	233,535 (1910-1919)
1931	3,962,344	2.6	51.4	113.1	34.6	268,062 (1920-1929)
1943	4,778,583	1.6	54.6	109.6	41.7	-147,963 (1930-1944)
1953	5,829,029	2.0	57.0	105.0	50.9	-21,920 (1945/49-1953)
1970	8,569,121	2.3	60.5	105.2	77.2	
1981[c]	9,706,369	1.1	69.0	102.4	87.5	-599,012 (1959-1979)

[a]Males per 100 females.
[b]Inhabitants per square kilometer. Figures pertain to the national territory at the time of the census.
[c]Provisional data.

Sources: 1899-1970 figures: Centro de Estudios Demograficos (1976); Comite Estatal de Estadisticas (1980). 1981 figures: Comite Estatal de Estadisticas (1981a). Net international migration data 1959-79: Comite Estatal de Estadisticas (1980); Gonzalez et al. (1978); JUCEPLAN, C.E.E. (1979).

secularized country with a high proportion of European-origin inhabitants, high literacy, well-developed communication and transportation systems, and predominantly large-scale plantation farming that employed seasonal wage labor. In spite of steady and seasonal unemployment, real per capita income was higher in 1958 than in 1943; real nonagricultural wages showed consistent improvement throughout this period (Dominguez, 1978).

With regard to the proximate determinants of fertility, the absence of empirical data on abortions and contraception and the dubious quality of census data pertaining to nuptiality preclude an examination of trends and the relative significance of various intermediate variables. In the absence of organized family planning programs and modern contraceptive methods, reliance on traditional methods of contraception (condom, withdrawal, rhythm, douche) and abortion is an obvious factor. Although in theory illegal, abortions were openly performed by physicians and by less-skilled practitioners for even lower fees; they were available throughout the country, but especially in Havana. Prior to the revolution, Cuba's medical health system was highly developed through mutualist insurance plans and a fairly extensive system of public hospitals and dispensaries, which accounts in part for the low infant mortality and high life expectancy attained by the population. Analysis of provincial and rural-urban fertility differentials during the 1960s and 1970s, discussed further below, provides greater detail on these factors. The role of other factors, such as age at marriage or changes in the proportion of women in reproductive unions, cannot be determined because of statistical shortcomings in the early census data, most notably the misreporting of women in consensual unions as single women.

Table 5 illustrates a variety of estimates of Cuban mortality. The accuracy of these estimates, which are far less reliable than those of fertility, is hampered by deficiencies in death registration throughout the first part of the century; all of these estimates are approximations, considering that the census data themselves are deficient and the underlying assumptions about underregistration of deaths are incorrect. The assumptions underlying the various estimates and their calculations, as well as those underlying the calculations for this study, are discussed in Appendix 2.

According to Collver's (1965) estimates for 1920-44, mortality declined beginning in the early 1900s (CDR of

TABLE 5 Estimated Crude Birth, Death, and Infant Mortality Rates, Rates of Natural Increase, and Life Expectancy at Birth, 1900-54: Cuba

Period	Crude Birth Rate[a]	Crude Death Rate[b]	Crude Rate of Natural Increase	Infant Mortality Rate[c]		Infant Mortality Rate[d]		Life Expectancy at Birth[e]
1900-04	42.0	23.7	18.3	136	(1900)	224		
1905-09	47.6	23.3	24.3	146	(1905)	215	(1905)	36.4
1910-14	43.6	21.4	22.2	140	(1910)	207		
1915-19	40.4	22.2	18.2	136	(1915)	199	(1915)	37.2
1920-24	37.8	19.3	18.5	135	(1920)	192		
1925-29	35.9	15.2	20.7	110	(1925)	184	(1925)	39.2
1930-34	34.6	13.3	21.3	76	(1930)	167		
1935-39	33.8	12.7	21.1	78	(1935)	151	(1937)	46.4
1940-44	33.4	10.9	22.5	61	(1940)	139		
1945-49	32.1	14.1	18.0	52	(1945)	124		
1950-54	29.7	11.6	18.1		(1950)	97	(1953)	58.8
					(1952-54)	79		

Sources: [a]CBR 1900-54: Catasus Cervera et al. (1975).
[b]CDR 1900-44: Collver (1965). Collver's estimates of crude death rates from 1920-44 are underestimates. This period coincides with the era of heavy immigration into Cuba and the estimates depend on the most deficient census of the 1900s, the Cuban census of 1931. In addition, unrealistically low infant and child mortality assumptions are made for these years. CDR 1945-53: Gonzalez and Debasa (1970) overestimate mortality and are sharply out of line with previous estimates of CDR.
[c]IMR 1900-49: Collver (1965) (underestimates).
[d]IMR 1900-54: Velazquez and Toirao (1975); Mezquita (1970); Gonzalez and Debasa (1970) (overestimates).
[e]e_0 1905-53: Diaz-Briquets (1981); Gonzalez and Debasa (1970).

24), with sharper declines registered after 1925 (CDR of 15). However, Collver's figures are thought to be underestimates. The period in question coincides with the era of heavy immigration into Cuba, and Collver's estimates depend in part upon the most deficient Cuban census of the 1900s--that of 1931. In addition, the infant and child mortality assumptions made for these years are unrealistically low. The Cuban estimates of the crude death rate for the post-1945 period differ from Collver's and are similarly unreliable. The CDR of 14.1 for 1945-49 varies widely from the rates prior to 1945; the estimate of 11.6 for 1950-54 is also unacceptable. (New estimates based on age distribution from 1931 and age distribution of deaths around that time were required for the estimates constructed in Appendix 2.)

Similar variations can be found in estimates of infant mortality by Collver; they can also be found in Cuban estimates based on life tables by Velazquez and Toirao (1975) for the years 1900-50 and on estimates by Gonzalez and Debasa (1970) for the early 1950s. However, there are similar time trends: a slow persistent decline in infant mortality from 1900-04 to 1925-29, just after the decline in fertility began, and sharper declines after 1945. Following World War II, as in other developing countries, Cuba's mortality decline accelerated with the availability of modern drugs and insecticides. While the Collver figures are underestimates, those of Gonzalez and Debasa are overestimates. For as late as 1948, Gonzalez and Debasa estimate that death registration of children younger than age 5 omitted approximately 65 percent of male deaths and 62 percent of female deaths. A comparison between the Gonzalez and Debasa 1952-54 life tables and the 1953 age distribution, conducted for this study, suggests that Gonzalez and Debasa overestimate mortality, particularly for males. The age pattern of adult mortality in conjunction with the age distribution indicates a West mortality level of 19.1 for males and 18.2 for females, implying an e(5) of 61.8 for males and 63.5 for females. These levels of adult mortality are consistent with an infant mortality rate of 60 in the early 1950s, assuming that the West mortality pattern remains at a constant level at all ages. This assumption is justified by results for 1970, when the infant mortality rate derived from adjusted mortality rates in adulthood is about 38, a rate highly consistent with the estimates of child mortality around 1970 obtained from children ever born and children surviving. The lower level of child

mortality is further confirmed by the fact that it produces plausible birth rates for the preceding 15 years when the reverse survival technique is applied to the age distribution. Expectation of life at birth for both sexes for 1952-53 based on the estimates constructed in Appendix 2 is 62.2; the crude death rate, given the 1953 age distribution, is 9.1; and the rate of natural increase is 19.2 per 1,000, assuming a birth rate of 28.3.

In conclusion, as Table 4 shows, Cuba's population growth rate was higher at the beginning of the century (1899-1931) than during and after World War II, mainly because of international migration. By 1958, the year prior to the revolution, Cuba's demographic profile was one of the developing world's most advanced. Life expectancy at birth was more than 60 years, and the birth rate had declined to the mid-20s per 1,000 population. Within Latin America, this life expectancy was surpassed only by rates recorded in Argentina, Uruguay, Puerto Rico, and Jamaica; only Argentina and Uruguay had achieved such low fertility. Even today, most developing nations have not yet attained the fertility levels characteristic of Cuba more than 20 years ago. Life expectancies comparable to those recorded in prerevolutionary Cuba have been reached in only a few developing countries, primarily in Latin America and East and Southeast Asia.

POSTREVOLUTIONARY DEMOGRAPHIC TRENDS

General Trends

Trends in Cuba's postrevolutionary mortality show a continuous increase in life expectancy. Although the crude death rate remained relatively stable, fluctuating between 5 and 8 deaths per 1,000 population during most of the period, infant mortality continued to decline. Official Cuban estimates indicate that infant mortality increased somewhat in the immediate postrevolutionary period perhaps due to improvements in death registration counts, balanced by the emigration of physicians during the early postrevolutionary years; in actuality, however, the rate may have continued to fall. After a period during which infant mortality showed little general trend in the late 1960s (40 per 1,000 in 1965, 39 per 1,000 in 1970), the 1970s saw a period of sharp decline with a provisional rate of 18.5 by 1981, the lowest infant mortality rate in Latin America.

For around 1970, an evaluation of registered deaths made for the present study (see Appendix 2) suggests that male deaths were effectively completely registered up to age 60 or so, whereas there was still some underregistration of female deaths. After adjustment, male deaths imply an East model life table level of 22.1, while female deaths imply a level of 21.3. The implied infant mortality rate is 38; this is highly consistent with the indirect estimates available from the 1974 National Survey of Income and Consumer Expenditures of the Population and the 1979 National Demographic Survey, which both indicate an East level of around 22.0 for both sexes for around 1970. These figures are also in close agreement with the official infant mortality rate for 1970 of 38.8. (A difference of half a level in child mortality in favor of males is supported for both 1953 and 1970 by the reverse survival calculations, which give plausible sex ratios at birth in both years using this difference.) The crude death rate for 1970, applying the selected life tables to the census age distribution, is 7.5; however, this rate is exaggerated by overreporting of age at older ages. Simply adjusting reported deaths for estimated coverage gives a death rate of 6.7, but this rate is biased downward by omission of deaths at old ages. The true value probably lies between 6.7 and 7.5, but should be higher than the official figure of 6.3.

However, for the most recent time period, 1976 onward, indirect estimates of child mortality obtained from the 1979 National Demographic Survey (see Appendix 2) do not corroborate the pace of the apparent decline in infant and child mortality. The proportions dead among children born of young mothers, those most affected by a recent decline, are actually higher for 1979 than for 1974--.0343 against .0281 for women aged 15-19, .0357 against .0351 for those aged 20-24. Although the indirect mortality estimates described in Appendix 2 and the official figures are not strictly comparable, the proportions for 1979 are not consistent with infant mortality rates in the low 20s from 1976 to 1979; rather, an infant mortality level of around 30 for 1976-79 is suggested, with no very pronounced trend. Thus, the indirect estimates suggest similar infant mortality and higher adult mortality around 1970 than the official series and do not corroborate the rapid decline in infant and child mortality since 1975, although sampling biases and the possible inclusion of abortions among dead children may account for this discrepancy.

TABLE 6 Demographic Trends, 1953-81: Cuba

Year	Crude Birth Rate	General Fertility Rate[a]	Crude Death Rate	Infant Mortality Rate	Estimated Total Population[b]	Crude Rate of Natural Increase[c]
1953	28.3	129.2			6,128,797	
1954	28.1	126.4			6,156,173	
1955	27.5	123.7			6,279,474	
1956	26.6	120.0			6,408,944	
1957	26.1	118.0			6,539,282	
1958	26.1	119.6	7.3	36.7	6,763,061	18.8
1959	27.7	127.1	7.4	37.6	6,900,888	20.3
1960	30.1	138.0	7.0	40.4	7,027,212	23.1
1961	32.5	150.1	7.1	41.8	7,134,003	25.4
1962	34.3	158.1	7.7	45.7	7,254,377	26.6
1963	35.1	162.9	7.3	41.1	7,414,886	27.8
1964	35.0	164.5	6.9	40.0	7,612,277	28.1
1965	34.3	163.0	7.1	39.7	7,809,918	27.2
1966	33.5	158.7	6.4	37.3	7,885,519	27.1
1967	31.7	153.0	6.3	36.4	8,139,334	25.4
1968	30.4	147.5	6.5	38.3	8,283,935	23.9
1969	29.2	142.1	6.6	46.7	8,421,050	22.6
1970	27.7	135.1	6.3 (6.7-7.5)[d]	38.8 (38)[d]	8,551,390	21.4
1971	29.5	143.2	6.0	36.5	8,691,660	23.5
1972	28.0	136.1	5.6	28.7	8,859,413	22.4
1973	25.0	121.6	5.6	29.6	9,034,564	19.4
1974	22.0	107.3	5.8	29.3	9,192,136	16.3
1975	20.7	100.0	5.5	27.5	9,335,380	15.2
1976	19.8	94.2	.6	23.3 (35)[d]	9,470,968	14.2
1977[a]	17.6	82.3	5.8	25.0	9,592,974	11.8
1978[a]	15.3	70.0	5.7	22.3	9,693,736	9.6
1979[a]	14.7	65.7	5.6	19.3	9,774,616	9.1
1980[a]	14.1	62.1	5.7	19.6	9,731,766	8.4
1981[a]	14.0	60.0	--	18.5	9,706,369	--

[a]Provisional rates.
[b]Estimates of population on June 30 of each year, calculations based on preliminary results of 1970 census.
[c]Crude birth rate minus crude death rate.
[d]Estimates by Hill (see Appendix 2).

Sources: 1953-65 figures: Landstreet and Mundigo (1978:Table 1); Ministerio de Salud Publica de Cuba (1978, 1979, 1981); age composition of the female population based on data from United Nations (1976). 1966-80 figures: JUCEPLAN, C.E.E. (1981); Ministerio de Salud Publica de Cuba (1978, 1979, 1980, 1981); United Nations (1976); 1981 figures: Comite Estatal de Estadisticas (1981a); UNFPA (1982a, 1982b).

Postrevolutionary fertility trends show three distinct phases. As noted in Table 6, during the postrevolutionary baby boom period from 1959-64, the crude birth rate increased from 28 per 1,000 population to 35 (similar to the birth rate estimated for 1920-24). The general fertility rate increased from 127 births per 1,000 women of reproductive age in 1959 to 165 births in 1964, triggered by increased childbearing among younger women. The baby

boom was followed by a slow decline in fertility from 1965 to 1973, except in 1971, which registered a slight rise. This rise in part may reflect a postponement of births in 1970, when some 190,000 to 235,000 workers were mobilized from the cities in an attempt to harvest ten million tons of sugar cane, nearly double the average produced annually during the 1960s, creating an upheaval in other sectors of the economy.[2] The brief fertility rise may also have been related to the marked rise in marriages in the late 1960s and early 1970s, when, concomitant with a period of heavy emigration from Cuba, crude marriage rates doubled over the previous rates for the mid-1960s. By 1973, the crude birth rate (25 births per 1,000 population) and general fertility rate (122 births per 1,000 women aged 15-44) had finally approached prerevolutionary levels.

Trends in fertility from 1973 to 1981 have been particularly striking. The crude birth rate declined 44 percent to an extremely low rate of 14 births per 1,000 population in 1981; the general fertility rate declined from 122 to 60 births per 1,000 women aged 15-44. The latest decline in fertility, occurring at a time when the crude death rate had stabilized at a low level of 5.6-5.8 deaths per 1,000 population, resulted in a decline in crude rates of natural increase from 19 in 1973 to 8 by 1980.

Figure 2 illustrates the course of Cuba's birth rate from 1958 to 1980, based on official figures in Table 6. The low death rate of 5.7 per 1,000 population in 1980 is far below the U.S. rate of 8.7 for the same year, reflecting the young age of the population, as well as continuing improvements in health since 1959. Cuba's 1980 crude rate of natural increase (8) compares with 7 in the U.S. and, along with the rates for Barbados and Uruguay, is now the lowest of all the Caribbean and Latin American nations (National Center for Health Statistics, 1981; Population Reference Bureau, 1982).

Concurrent with fertility decline, emigration from Cuba over the past 20 years has reduced population growth rates even further. The nation's postrevolutionary baby boom was partially offset by emigration, which reached an early peak between 1960 and 1962, interrupted in late 1962 by the missile crisis. A subsequent wave of emigration from late 1965 until 1972 resulted from an agreement between the U.S. and Cuban governments. If not for a net emigration of approximately 507,422 persons, the Cuban growth rate of 2.0 percent for the decade 1960-70 would have been approximately 2.6 percent.

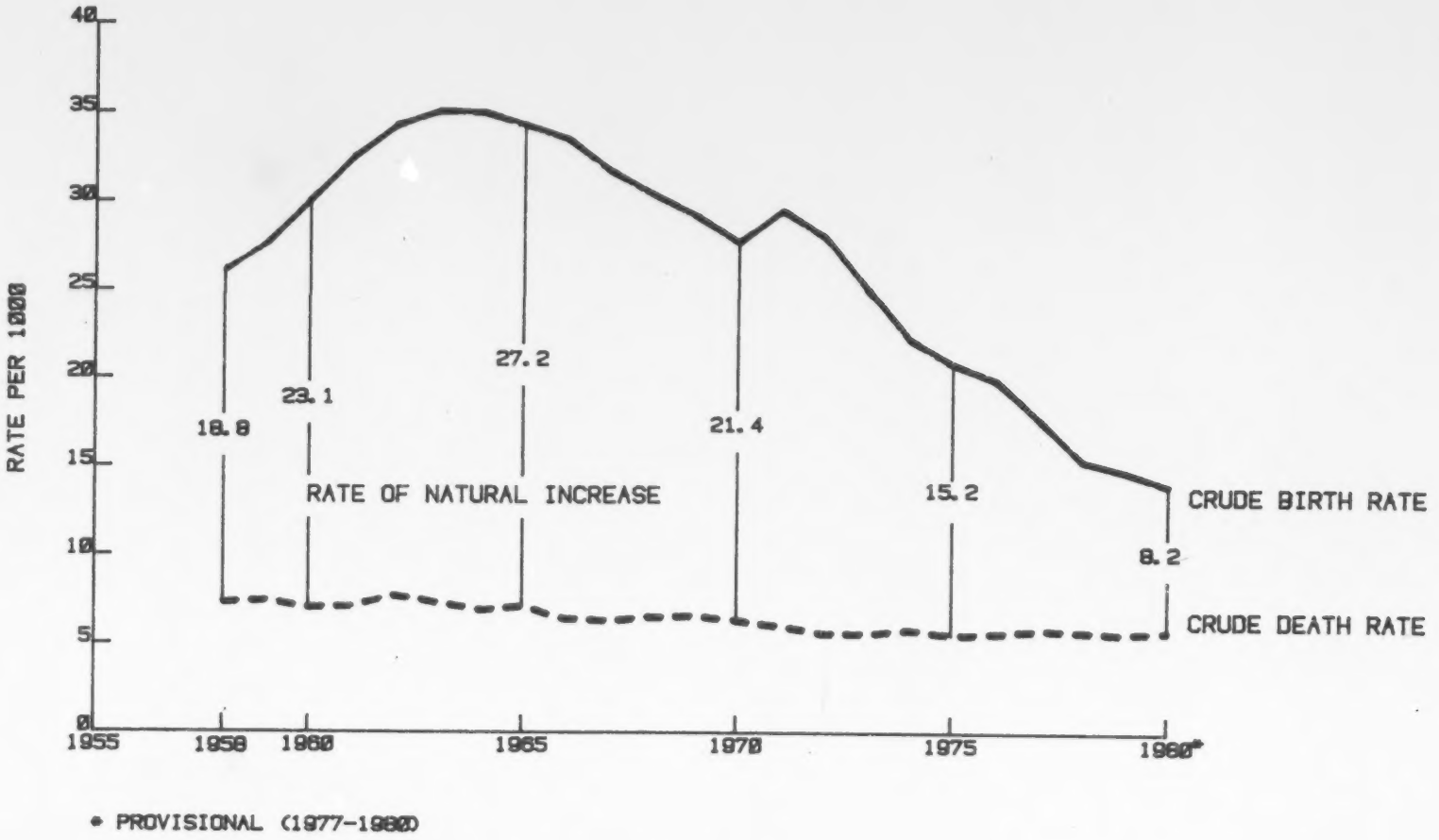

FIGURE 2 Trends in Population Growth, 1958-80: Cuba

The latest surge in emigration, through the Mariel small-boat evacuation, permitted the departure of an additional 125,000 Cubans. The emigration was officially ended by U.S. authorities in mid-1980; additional population losses occurred through subsequent illegal immigration into Florida. Latest Cuban data show a decline in the total population to an estimated 9,731,766 in 1980 through the emigration of 124,000 people; the estimated population for 1981, according to preliminary census figures, is 9,706,369 (Comite Estatal de Estadisticas 1981a).[3]

The combination of a fluctuating birth rate and sizable emigration is reflected in Cuba's population pyramid. The estimated 1980 pyramid, based on data in Table 7 and depicted in Figure 3, shows a rather large bulge between ages 5 and 19, the age group containing the population born during the baby boom years of the early 1960s. The disproportionately large size of the bars at these ages also reflects infant mortality declines. The marked indentation below age 5 is produced by the very rapid fertility decline in recent years, particularly since the mid-1970s. Above age 20, the shape of the pyramid is consistent with what might be expected in a country that has experienced a gradual fertility decline to moderate levels by the late 1950s, accompanied by an equally gradual mortality decline.

Trends in Age-Specific Fertility

More detailed analyses of Cuban fertility trends in the immediate pre- and postrevolutionary periods are based on Cuban and CELADE estimates for five-year intervals from 1950-55 to 1975-80 and Cuban estimates for single-year intervals from 1970-80, shown in Tables 8 and 9 and depicted graphically in Figures 4 and 5. These estimates suggest that the postrevolutionary baby boom occurred among all age groups, but resulted primarily from a shift toward earlier childbearing and higher fertility among younger women, especially those aged 15-19 and 20-24; fertility among older women age 35 and over shows less significant increases (see Figure 4). The subsequent decline in the late 1960s can be attributed to lower marital fertility, primarily among women age 25 and above. By 1970, all age groups (with the exception of those 15-19) had experienced fertility declines, with 20-29 as the primary reproductive period, indicating a

TABLE 7 Data for Population Pyramid, 1980: Cuba

Age Group	Male	Female
0-4	4.12	3.93
5-9	5.71	5.47
10-14	6.18	5.92
15-19	5.98	5.70
20-24	4.07	3.91
25-29	3.80	3.68
30-34	3.57	3.48
35-39	3.24	3.15
40-44	2.82	2.75
45-49	2.26	2.23
50-54	2.07	2.05
55-59	1.76	1.73
60-64	1.62	1.54
65-69	1.38	1.29
70-74	1.10	.99
75-79	.84	.72
80+	.48	.47
Total	50.99	49.01

Source: Comite Estatal de Estadisticas and CELADE (1980b:Table 3).

further shift toward earlier childbearing and sustained lower fertility among women age 25 or older.

The total fertility rate expresses the average number of births per woman if all women lived to the end of their childbearing years and bore children according to a given set of age-specific fertility rates. This rate increased from 3.8 in the late 1950s to 4.7 in 1960-65 and subsequently declined in the latter 1960s to 4.3. By 1970-75, the figure finally fell to 3.5, below prerevolutionary levels (according to Cuban figures). Similarly, the gross reproduction rate[4] of 1.8 female births per woman in 1955-60 increased to 2.3 in 1960-65, then declined to 1.8 by 1970, to .93 by 1978, and to .77 by 1980. Cuban fertility is currently well below "replace-

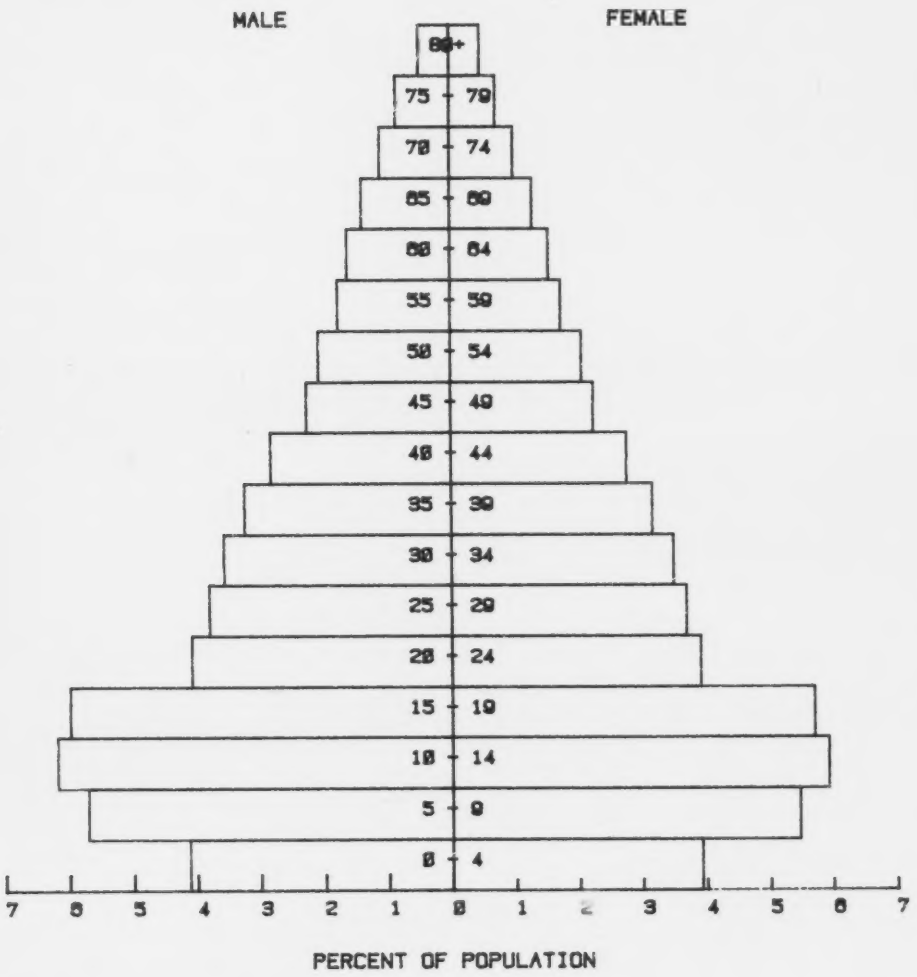

FIGURE 3 Population Pyramid, 1980: Cuba

ment level"; that is, if fertility continued at this level, annual births would eventually fall to or below the level of deaths, and Cuba's population would cease growing from natural increase.

Table 9 and Figure 5 compare downward trends in age-specific fertility rates, reflected in the rapid birth rate decline since 1973. From 1973 to 1980, birth rates fell by 70 percent or more among women aged 30 to 44 and 87 percent among less fertile women 45 or older; among women 25-29, fertility remained stationary from 1970-72 before descending; among women aged 20-24 and 15-19, fertility peaked in 1971-72 and subsequently

TABLE 8 Fertility Rates, 1950-80: Cuba

Age Group	Births per 1,000 Women					
	1950-55	1955-60	1960-65	1965-70	1970-75	1975-80
15-19	65.4	78.8	119.7	130.1	137.5	75.4
20-24	228.4	214.4	266.4	244.8	190.2	156.5
25-29	226.4	201.9	237.9	206.8	161.3	107.9
30-34	154.5	138.7	164.8	144.4	108.2	56.7
35-39	87.9	81.8	100.9	92.0	65.1	28.8
40-44	32.0	29.6	36.3	32.8	26.0	9.8
45-49	7.3	6.7	8.1	7.3	5.8	1.0
Total Fertility Rate	4.01	3.76	4.67	4.29	3.47	2.18
Gross Reproduction Rate	1.95	1.83	2.27	2.09	1.69	1.06
Net Reproduction Rate	1.64	1.58	2.03	1.92	1.59	1.02

Sources: Comite Estatal de Estadisticas (1980); Comite Estatal de Estadisticas and CELADE (1981:Tables 5 and 6).

declined (47 and 41 percent, respectively). Among this latter youngest group, the speed of decline lagged somewhat until 1977, when fertility dropped precipitously.

The age-specific fertility rates of Cuban women aged 15-19 during the mid-1970s are similar to those recorded for Panama and Jamaica (123-130) in the same time period; they are higher than those estimated for Costa Rica, the Dominican Republic, Martinique, Mexico, and Puerto Rico (ranging between 51 and 110 births per 1,000 women aged 15-19) and for all of the South American countries except Paraguay (Population Reference Bureau, 1981). The age-specific fertility rates of Cuban women aged 15-19 declined during the late 1970s, approaching the levels achieved by many Latin American countries in the mid-1970s; however, the rates are still high when compared to age-specific fertility rates of young women in other low-fertility nations.

TABLE 9 Fertility Rates, 1970-80: Cuba

Age Group	Births per 1,000 Women											Percentage Change 1973-80
	1970	1971	1972	1973	1974	1975	1976	1977	1978[a]	1979[a]	1980[a]	
15-19	127.5	146.5	143.8	134.7	129.7	127.1	126.5	103.3	83.0	74.5	80.2	-40.5
20-24	227.4	245.7	237.6	208.3	182.3	178.3	170.7	155.4	137.2	131.8	110.9	-46.8
25-29	164.6	174.7	167.9	146.1	125.4	116.1	111.2	96.9	83.9	80.2	68.4	-53.2
30-34	116.3	120.3	113.0	97.6	80.2	67.3	59.9	53.3	45.6	43.7	35.5	-63.6
35-39	73.5	71.1	66.1	56.2	46.2	36.6	32.3	28.0	23.9	22.4	16.4	-70.8
40-44	25.8	25.6	23.7	21.2	16.3	13.4	11.1	9.7	8.2	7.6	4.3	-79.7
45-49	3.9	2.8	2.7	3.1	2.5	2.2	1.9	1.7	1.5	1.4	0.4	-87.1
Total Fertility Rate	3.70	3.93	3.77	3.34	2.91	2.70	2.37	2.24	1.92	1.81	1.58	-52.7
Gross Reproduction Rate	1.80	1.91	1.83	1.62	1.42	1.32	1.16	1.09	.93	.88	.77	-52.5

[a]Preliminary rates.

Sources: 1970-79 figures: Comite Estatal de Estadisticas in Avalos Triana Monent (1981:Tables 3 and 4); Comite Estatal de Estadisticas (1980). 1980 figures: Ministerio de Salud Publica de Cuba (1981).

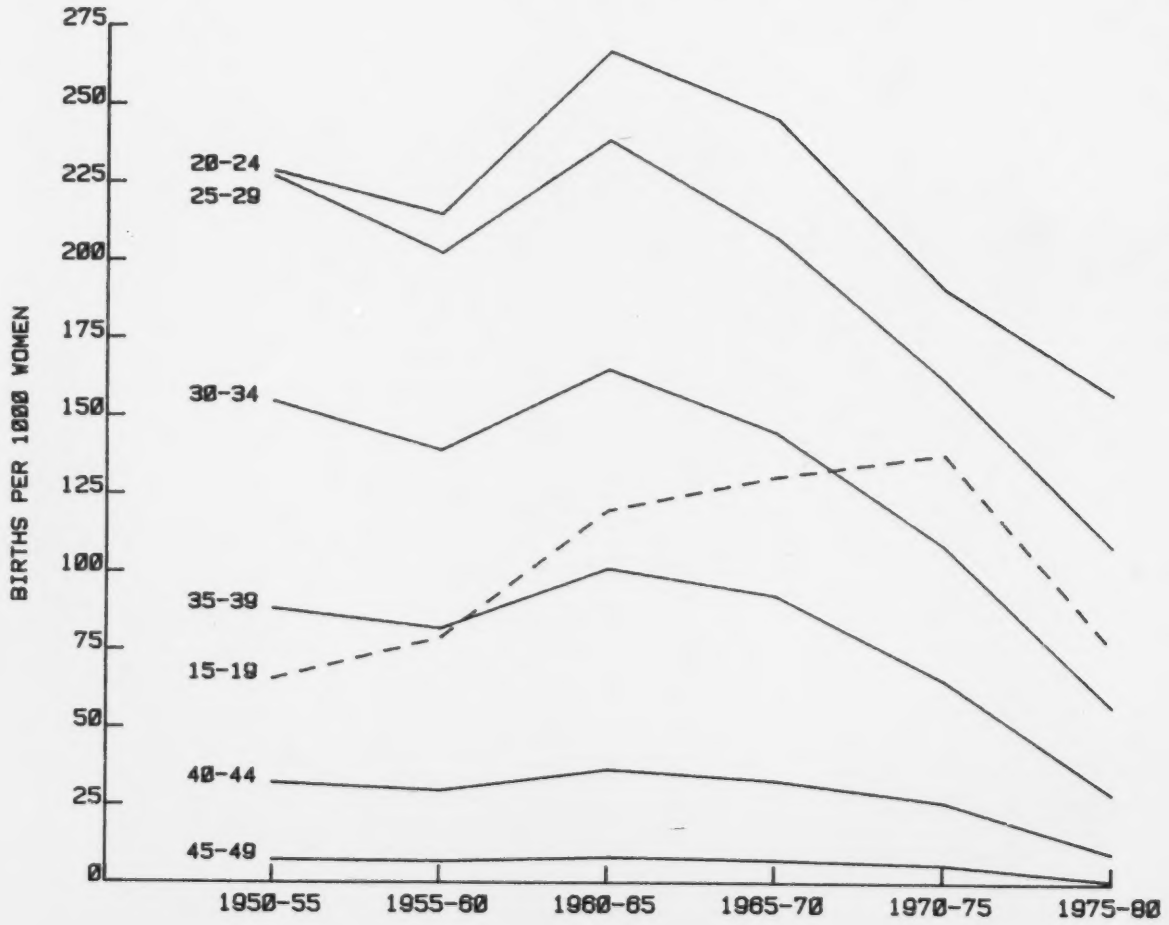

FIGURE 4 Fertility Rates, 1950-80: Cuba

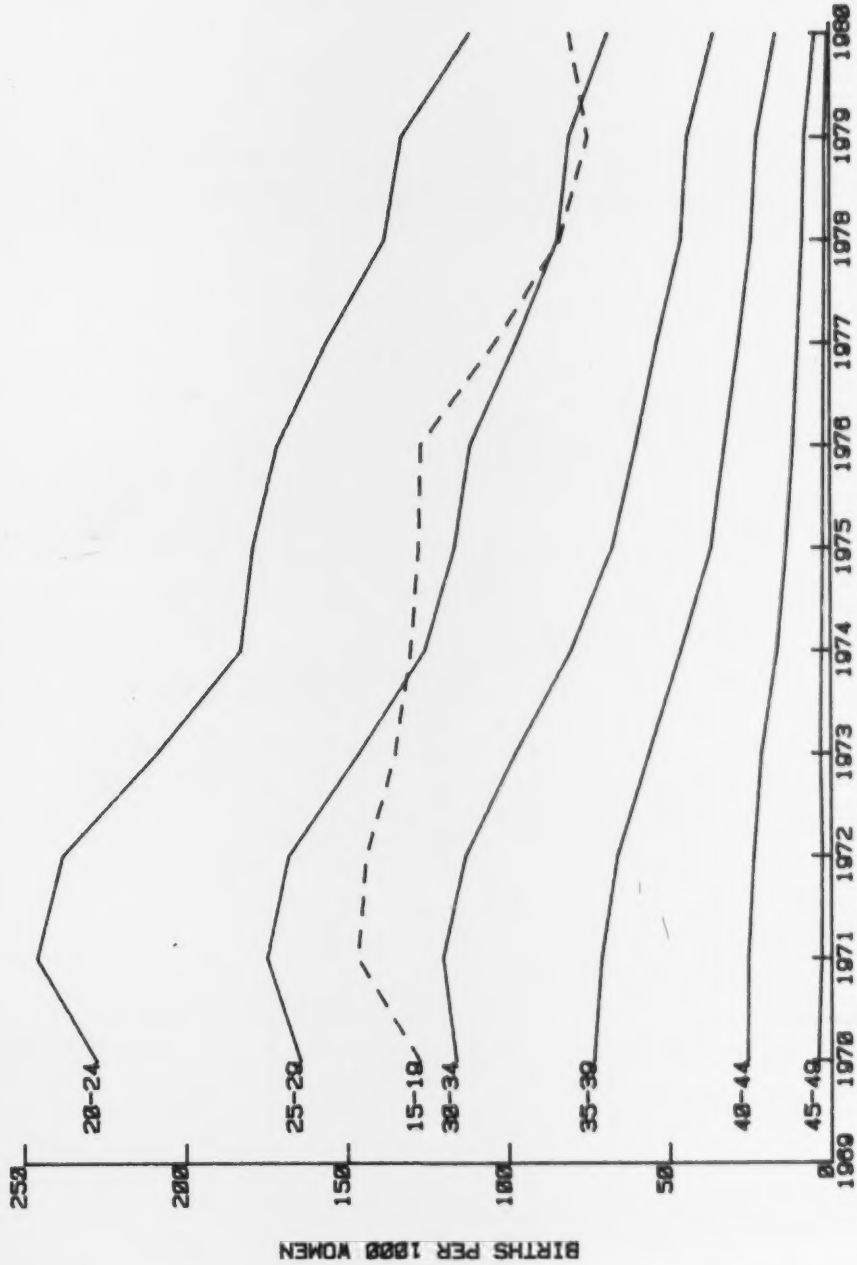

FIGURE 5 Age-Specific Fertility Rates, 1970-80: Cuba

Trends in Provincial and Rural-Urban Fertility

Additional data on fertility in postrevolutionary Cuba are provided by provincial crude birth rates calculated for all years from 1953-80, with the exception of 1976 (see Table 10). In Fall 1976, a new political and administrative division of national territory was established to facilitate regional economic planning. In place of the six provinces that had existed since the nineteenth century, 14 were created, with Isla de Pinos (now named Isla de la Juventud) as a special municipality outside the new system. Within these provinces, a total of 169 municipalities was created. Figure 6 provides a map of Cuba with its new political divisions. To permit time-series comparison, Cuban data for 1977-80, available for the 14 provinces, have been recombined to correspond to the original six provincial divisions.

As previously noted in the discussion of prerevolutionary fertility trends, provincial crude birth rates declined from 1953 to 1958, except in La Habana, where fertility remained constant. In 1959, at the inception of the postrevolutionary baby boom, crude birth rates were lowest for the provinces of La Habana and Matanzas (22-23 births per 1,000 population), moderately low in Las Villas and Camaguey provinces (25-27), and highest for the rural provinces at the extreme eastern and western ends of the island, Pinar del Rio and Oriente (30-35). The postrevolutionary baby boom, peaking in 1964, occurred in all provinces, but was sharpest in La Habana, Matanzas, and Las Villas, where the crude birth rates increased 41, 36, and 34 percent, respectively, over 1959 rates. The smallest increase (14 percent) was recorded in Oriente province, which originally had the highest fertility.

By 1970, provincial crude birth rates had again approximated their prerevolutionary levels. From 1964 (the peak year of the postrevolutionary baby boom) to 1980, the crude birth rate fell at least 59 percent in all provinces, with the greatest decline recorded in La Habana (63 percent decline in fertility). Of equal significance is the reduction in interprovincial fertility differentials. Data for 1980 for both the old and new provincial divisions show that the crude birth rate was below the national average, ranging from 11 to 14 live births per 1,000 population in the central western provinces of La Habana (now La Habana and Ciudad de la Habana provinces), Matanzas, Las Villas (now Villa Clara,

Cienfuegos, and Sancti Spiritus provinces), and part of Oriente province (Holguin); above the national level (14.2-16.4) in the central eastern provinces of Camaguey (now Camaguey and Ciego de Avila), Pinar del Rio, and part of Oriente province (now Las Tunas and Santiago de Cuba); and highest (18-21) in another part of Oriente (now Guantanamo and Granma) and Isla de Pinos (now Isla de la Juventud), areas in which only 13 percent of the 1980 population resided. Thus, between 1959 and 1980, fertility differentials among provinces had narrowed, and the proportion of the population residing in the peripheral regions had declined considerably.[5]

Analysis of fertility levels and provincial and rural-urban differentials for the period 1965-77, based on estimates of fertility obtained through the own-children methodology, are illustrated in Tables 11 and 12 and Figures 7, 8, and 9. The data base is the 1979 Cuban National Demographic Survey, conducted March 22-31, which gathered data on household composition and socioeconomic variables on a sample of 68,046 households with a total of 326,174 persons, or 4 percent of all Cuban households[6] (Comite Estatal de Estadisticas and CELADE, 1981).

Table 11 shows the total fertility rates for former provincial divisions and rural-urban areas between 1965 and 1977. The total fertility rate declined about 50 percent, from 4.6 in 1965 to 2.3 in 1977. As noted, above, this decline was steady except for a slight rise or stabilization in some provinces in 1971-72, probably due to higher marriage rates in 1970-71 and postponement of births in 1970 with the mobilization of the population for the sugar cane harvest. In 1965, toward the end of the baby boom period, fertility rates were highest in the extreme eastern and western provinces of Pinar del Rio and Oriente (with TFRs of 4.9 and 5.4, respectively) in which the rural population constituted a majority (52 percent and 54 percent, respectively) (see Figure 7).

In urban areas, the total fertility rate of 4.1 in 1965 was already moderately low and clearly descending. In the rural areas, fertility was much higher (TFR of 6.0) and declined only after 1967. The interruption in the decline of fertility in the early 1970s occurred almost exclusively in the urban areas. As noted in Figures 8 and 9, declines in fertility between 1965 and 1977 were particularly sharp in rural areas, and by 1977, rural-urban differentials in fertility had been considerably reduced (TFR of 2.1 in urban areas and 2.7 in rural areas).

TABLE 10 Crude Birth Rates by Former Provincial Division, 1953-80: Cuba

Year	Province						
	Pinar del Rio	La Habana[a]	Matanzas	Las Villas	Camaguey	Oriente	Isla de la Juventud
1953	32.0	18.7	24.4	26.7	29.3	37.4	
1954	31.1	18.7	23.7	25.8	28.3	36.6	
1955	30.2	18.9	23.0	24.9	27.2	35.6	
1956	29.0	18.6	21.9	23.7	25.9	34.6	
1957	28.3	18.7	21.3	22.9	25.3	33.9	
1958	28.4	19.6	21.6	23.0	25.5	33.9	
1959	29.7	21.9	23.4	24.6	27.2	35.0	
1960	32.0	25.2	26.1	27.1	29.7	36.5	
1961	34.4	28.3	28.9	29.7	32.3	37.9	
1962	35.9	30.5	30.9	31.8	34.5	39.2	
1963	36.7	31.3	31.7	32.7	35.4	39.8	
1964	36.6	30.8	31.8	33.0	35.3	39.8	
1965	35.7	29.5	30.9	32.5	34.5	39.5	
1966	34.5	27.7	29.5	31.5	33.1	38.7	
1967	33.2	25.4	27.9	30.2	31.6	38.0	
1968	32.1	23.1	26.4	28.9	30.2	37.5	
1969	31.0	20.9	25.1	27.9	29.0	36.9	
1970	29.7	18.5	23.8	27.8	27.7	35.7	
1971	30.3	23.6	27.9	28.4	28.4	34.8	
1972	28.5	22.7	25.8	27.4	26.1	33.0	
1973	25.5	20.0	22.4	23.4	24.1	30.1	
1974	23.4	17.9	19.0	19.2	21.6	26.9	

1975	21.7	16.2	18.6	17.6	22.0	25.2	
1976[b]	--	--	--	--	--	--	
1977	19.7	14.3	15.9	15.6	18.7	20.8	22.1
1978[c]	18.0	12.5	14.0	13.8	15.8	17.6	20.0
1979[c]	16.6	11.8	12.6	13.2	15.4	17.3	19.8
1980[c]	15.0	11.5	12.2	12.8	14.4	16.4	21.0
Percent Change							
1953-58	-11.3	+ 4.8	-11.5	-13.9	-13.0	- 9.4	
1959-64	+23.2	+40.6	+35.9	+34.1	+29.8	+13.7	
1965-72	-20.2	-23.1	-16.5	-15.7	-24.3	-16.5	
1973-80	-41.2	-42.5	-45.5	-45.3	-40.2	-45.5	

Note: -- indicates data unavailable.

[a]Political emigration, predominantly from La Habana province, was notable during 1958-63 and 1965-72.

[b]In Fall 1976 a new political and administrative division of national territory was established. In place of the six provinces noted in this table, 14 were created. The provinces of Pinar del Rio and Matanzas remain essentially the same. For comparative purposes the data for 1977-80 have been retabulated to match the same provincial boundaries existing prior to 1976. At present, La Habana province is divided into the city of Havana and the rest of the province; Las Villas into Cienfuegos, Villa Clara, and Sancti Spiritus; Camaguey into Ciego de Avila and Camaguey; and Oriente into Las Tunas, Holguin, Granma, Santiago de Cuba, and Guantanamo. In addition, Isla de la Juventud was made a municipality outside the new system.

[c]Provisional.

Sources: 1953-59 figures: Gonzalez et al. (1978:Vol. 1, Table III-26). 1953-59 figures: Gonzalez et al. (1978:Table III-26). 1960-75 figures: JUCEPLAN, C.E.E. (1976:Table 10). 1977-80 figures: Ministerio de Salud Publica de Cuba (1978, 1979, 1980, 1981).

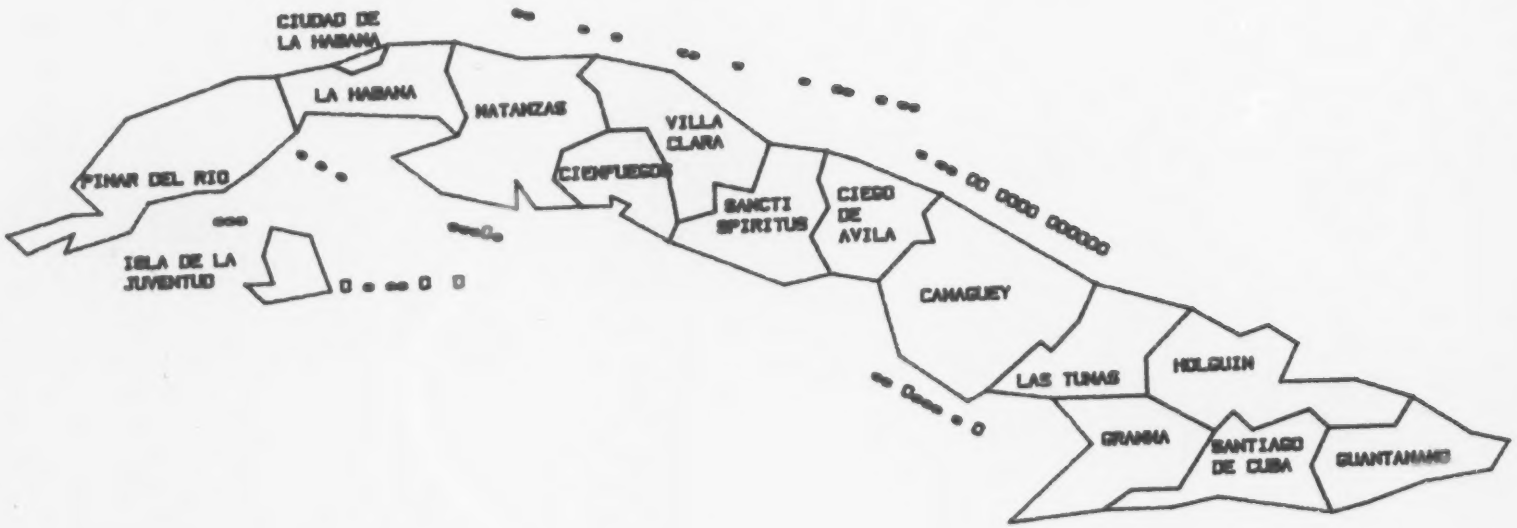

FIGURE 6 Provincial Map: Cuba

Trends in provincial fertility are similar. In Oriente and Pinar del Rio, characterized by a higher proportion of rural population, the decline in total fertility was steady and uninterrupted. In the other provinces, all of which were more urbanized and had lower fertility, some stabilization and slight increases in fertility were recorded in the early 1970s, with fertility descending again in 1973 (Figure 7). Although these fertility differentials among the six provinces remained basically similar, by 1977 the largest provincial differentials in total fertility had been considerably reduced (2.6 in Oriente and 1.9 in La Habana). The majority of the urban population (with the exception of Oriente) and the rural population of Matanzas and Las Villas had arrived at or near replacement-level fertility.

Table 12 shows total fertility rates for the period 1971-77 by new provincial divisions and rural-urban areas. Total fertility rates in the range of 1.9 to 2.3 characterized seven provinces (Ciudad de la Habana, Matanzas, La Habana, Villa Clara, Cienfuegos, Sancti Spiritus, and Ciego de Avila); rates of 2.4 to 2.6 were noted in four provinces (Pinar del Rio, Camaguey, Granma, and Santiago de Cuba); while higher rates of 2.7 to 2.9 were found in three (Holguin, Las Tunas, and Guantanamo). As previously mentioned, by 1980, crude birth rates were in the highest group in only two provinces: Guantanamo and Granma.

Fertility Desires

Data on fertility desires of Cuban women are available through basic tabulations from the 1979 National Demographic Survey, which questioned women aged 14-44 on the number of additional children they would like to have aside from those they already had. Women aged 45-49 in the sample were not asked such questions, on the assumption that they had already completed their family size. A second measure of the demand for children, expected family size, was constructed by totaling for each woman her number of surviving births and the additional number desired.[7]

When responses are classified by the current number of surviving births (Table 13), some unusual results appear: 41 percent of the women aged 14-44 living in union who were childless at the time of the survey (no births or surviving births) stated that they did not want additional children. This figure is much higher than the statistics

TABLE 11 Total Fertility Rates, by Former Provincial Division and Rural-Urban Residence, 1965-77: Cuba

Province	Births per 1,000 Women, 15-49												
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
CUBA													
Total	4.6	4.5	4.3	4.2	4.0	4.0	4.0	3.7	3.4	3.0	2.8	2.6	2.3
Urban	4.1	3.9	3.6	3.5	3.4	3.4	3.5	3.3	2.8	2.5	2.4	2.3	2.1
Rural	6.0	5.9	5.9	5.6	5.3	5.2	5.1	4.9	4.4	3.9	3.6	3.3	2.7
Pinar del Rio													
Total	4.9	4.7	4.5	4.3	4.2	4.0	3.9	3.7	3.4	3.0	2.8	2.6	2.4
Urban	4.3	4.2	4.1	3.9	3.6	3.6	3.5	3.3	2.9	2.6	2.4	2.3	2.2
Rural	5.4	5.2	5.0	4.8	4.7	4.5	4.4	4.2	3.8	3.4	3.1	2.9	2.6
La Habana													
Total	3.7	3.5	3.2	2.9	2.7	2.7	2.8	2.8	2.6	2.4	2.2	2.1	1.9
Urban	3.6	3.4	3.2	2.9	2.6	2.6	2.8	2.8	2.5	2.3	2.0	1.9	1.7
Rural	5.1	4.9	4.3	4.0	3.5	3.5	3.4	3.5	3.2	3.1	3.0	2.8	2.5
Matanzas													
Total	4.2	4.1	3.8	3.6	3.4	3.4	3.5	3.4	3.0	2.6	2.4	2.3	2.0
Urban	3.9	3.8	3.5	3.4	3.1	3.2	3.2	3.3	3.0	2.7	2.3	2.1	1.9
Rural	5.0	4.8	4.6	4.2	4.0	3.9	4.0	4.0	3.6	3.2	2.9	2.7	2.3

Las Villas													
Total	4.4	4.3	4.1	4.0	3.8	3.8	3.8	3.6	3.2	2.7	2.5	2.3	2.1
Urban	4.0	3.9	3.7	3.6	3.6	3.8	3.8	3.6	3.0	2.4	2.2	2.1	2.0
Rural	5.0	4.8	4.8	4.4	4.2	4.1	4.3	4.1	3.7	3.3	3.0	2.6	2.3
Camaguey													
Total	4.6	4.5	4.3	4.2	4.0	3.6	3.8	3.6	3.3	3.1	3.0	2.8	2.4
Urban	4.3	4.3	4.2	3.8	3.5	3.4	3.6	3.3	3.0	2.8	2.8	2.7	2.3
Rural	5.2	5.5	5.3	5.1	4.7	4.5	4.4	4.3	3.9	3.7	3.3	3.2	3.1
Oriente													
Total	5.4	5.3	5.2	5.1	5.0	4.8	4.5	4.2	3.8	3.5	3.3	3.0	2.6
Urban	4.7	4.6	4.6	4.4	4.2	4.0	3.8	3.6	3.2	2.9	2.7	2.8	2.7
Rural	6.6	6.4	6.4	6.4	6.4	5.7	5.7	5.7	5.0	4.5	4.0	3.7	3.1

Note: Based on women aged 15-49.

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 7).

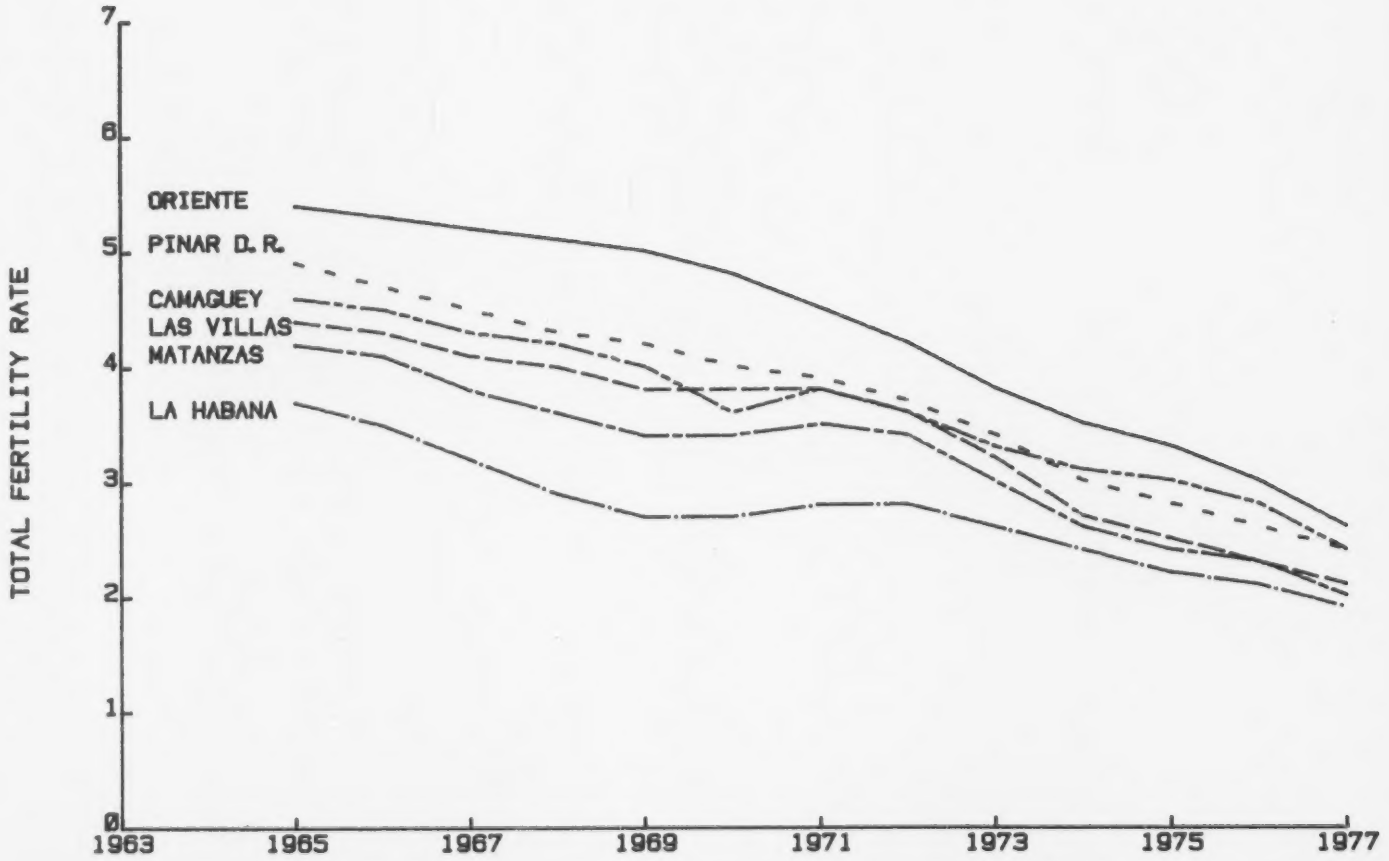

FIGURE 7 Total Fertility Rates, Rural and Urban Areas, Selected Years, 1965-77: Cuba

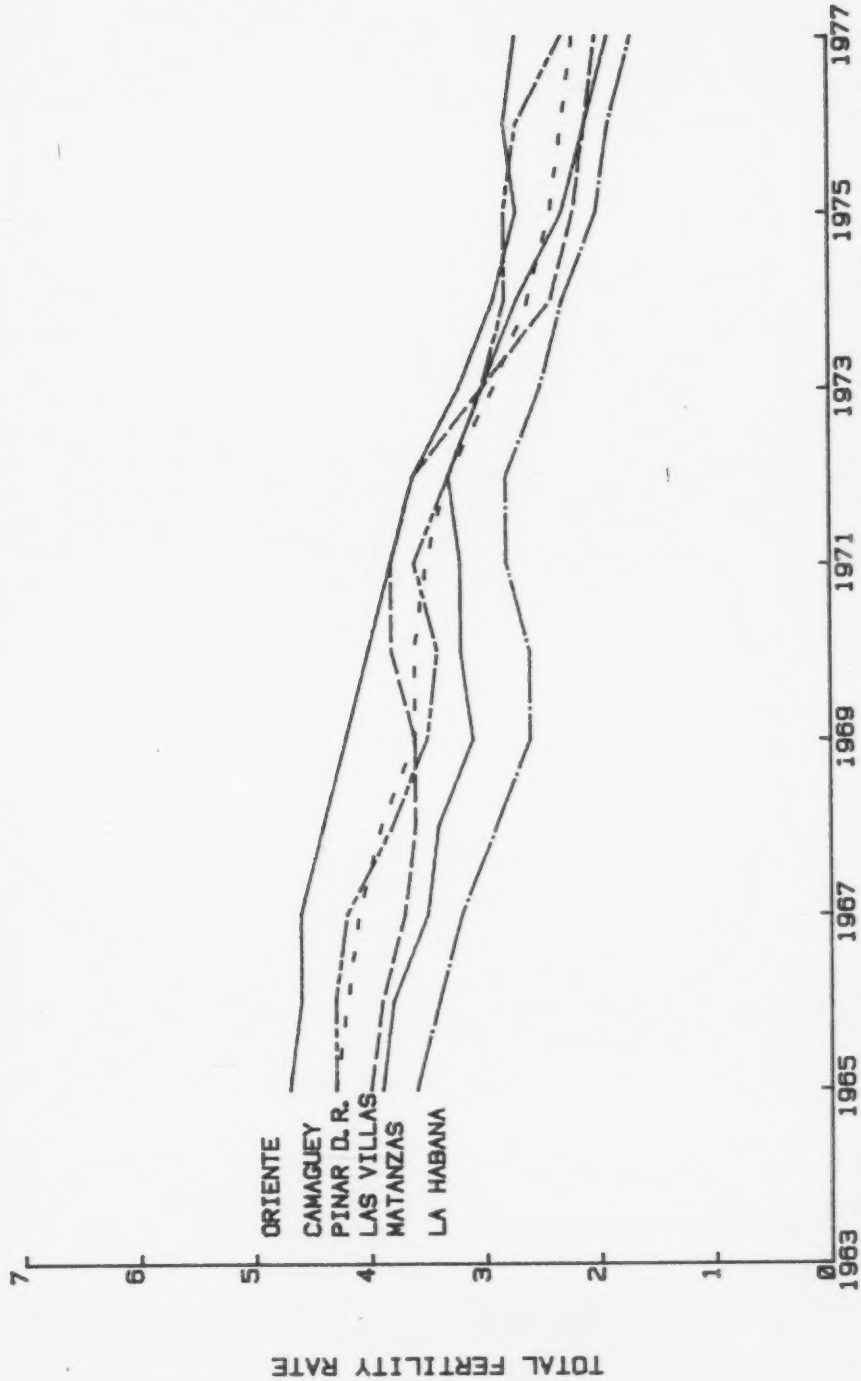

FIGURE 8 Total Fertility Rates, Urban Areas, Selected Years, 1965-77: Cuba

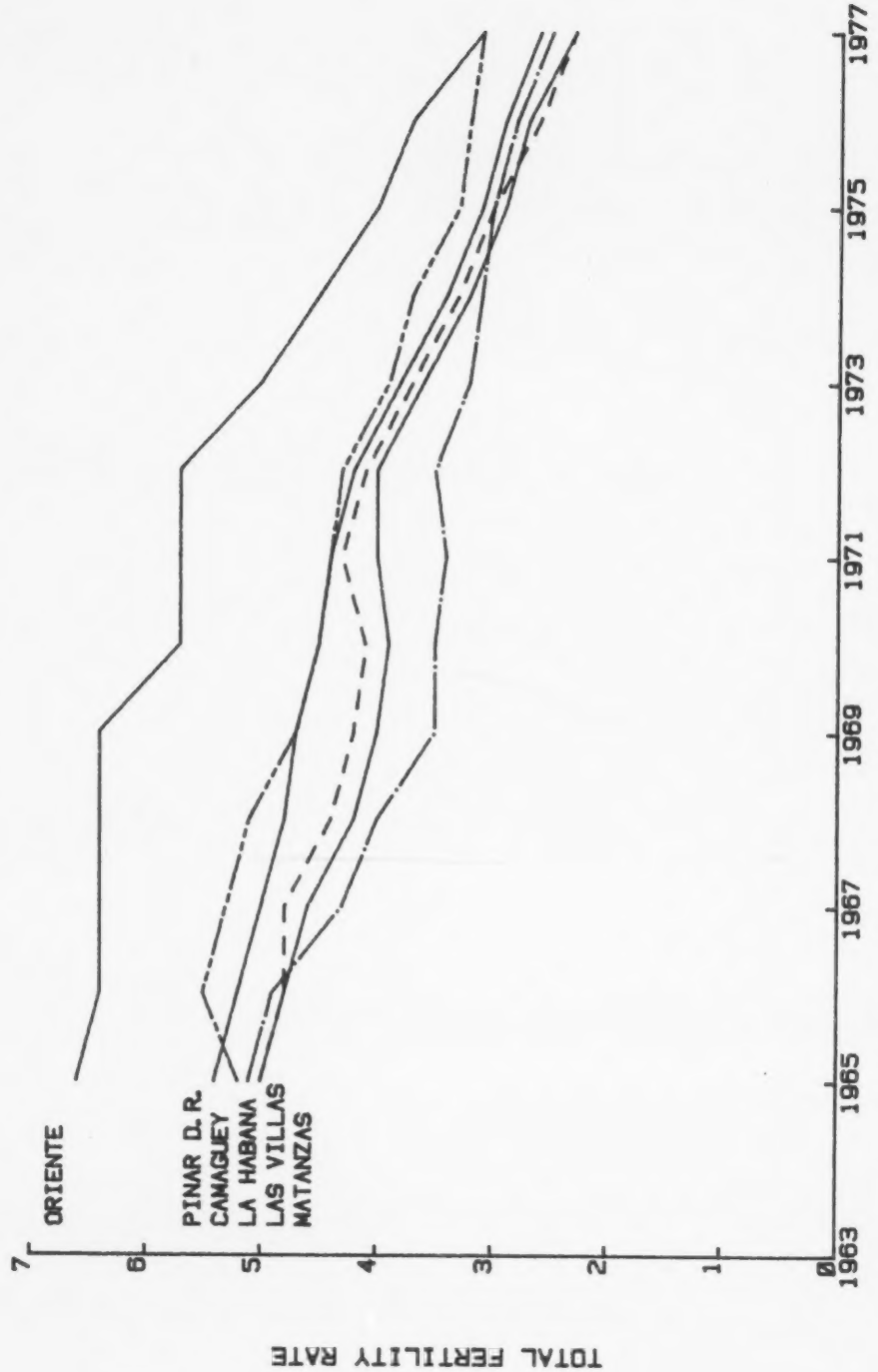

FIGURE 9 Total Fertility Rates, Rural Areas, Selected Years, 1965-77: Cuba

gathered from World Fertility Survey countries, although the two data sets are not strictly comparable (see note to Table 13). Coding problems in the Cuban data set and a possible misinterpretation of the question as related to spacing (see Footnote 7) may partially explain this discrepancy.[8] Questions on fertility desires for women of higher parity (one, two, and three) are more in line with the fertility desires of women in other low-fertility countries. For instance, among Cuban women with one surviving child, 43 percent stated that they did not want additional children, comparable to the proportions expressed in Japan and Czechoslovakia. Similarly, the proportions desiring no more children among women at parities two (86 percent) and three (93 percent) are similar to the proportions preferring no more children in low-fertility countries. On the other hand, in comparison to other Latin American countries with similar levels of economic development and educational attainment (Costa Rica, Panama), Cuban desires for additional children at parities zero, one, two, and three are much lower.[9]

When respondents are classified by age, as shown in Figure 10 and Table 14, nearly 42 percent of women less than 20 years of age with no surviving children declared that they did not desire additional children; this figure was 32 to 34 percent among women aged 20-24 and 25-29, and 42 percent among those aged 30-34. It is probable that a substantial proportion of young childless women intended to postpone the first birth rather than remain childless; as previously noted, this group included women with no response on fertility, and responses may have reflected spacing desires. Among women with surviving children, the desire for more is a function of the number surviving, which increases with the wife's age. For instance, among women aged 25-29 with one, two, or three living children, the proportions desiring no more children increase from 38 to 83 to 88 percent, respectively. Fertility desires are thus especially low among younger women: among those less than 20 years of age, for instance, 37 percent stated that they did not want additional children; among those who stated that they did want additional children, 59 percent desired only one, 33 percent two, and only 8 percent three.

Data on the average number of live births, surviving births, and number of additional children desired among women in union are classified by age group and educational attainment in Table 15. Except for women with incomplete primary education, there is relatively little difference

TABLE 12 Total Fertility Rates, by Present Provincial Division and Rural-Urban Residence, 1971-77: Cuba

Province	Births per 1,000 Women, Aged 15-49						
	1971	1972	1973	1974	1975	1976	1977
Pinar del Rio							
Total	4.0	3.8	3.3	3.0	2.8	2.6	2.4
Urban	3.4	3.4	2.7	2.7	2.4	2.3	2.2
Rural	4.3	4.3	3.9	3.2	3.1	3.0	2.5
La Habana							
Total	3.0	3.0	2.7	2.5	2.3	2.2	2.1
Urban	2.9	2.9	2.5	2.3	2.3	2.1	2.1
Rural	3.2	3.3	3.2	2.9	2.5	2.5	2.1
Ciudad de la Habana							
Total	3.1	3.1	2.7	2.4	2.2	2.1	1.9
Urban	3.1	3.1	2.7	2.4	2.2	2.1	1.9
Rural	--	--	--	--	--	--	--
Matanzas							
Total	3.5	3.5	2.9	2.5	2.4	2.3	2.0
Urban	3.2	3.2	3.2	2.6	2.2	2.1	2.0
Rural	4.0	4.0	3.9	2.9	2.9	2.9	2.2
Villa Clara							
Total	4.0	4.0	3.5	2.8	2.6	2.3	2.2
Urban	3.7	3.6	3.2	2.4	2.4	2.2	2.1
Rural	4.4	4.4	3.9	3.6	3.0	2.9	2.1
Cienfuegos							
Total	3.2	3.2	2.8	2.3	2.2	2.2	2.2
Urban	3.0	3.0	2.6	1.9	1.9	2.0	2.0
Rural	3.7	3.5	3.1	2.9	2.9	2.2	2.0
Sancti Spiritus							
Total	3.8	3.8	3.4	2.9	2.7	2.5	2.2
Urban	3.5	3.5	3.1	2.5	2.3	2.2	1.8
Rural	4.7	4.7	3.8	3.4	2.9	2.6	2.6
Ciego de Avila							
Total	3.6	3.5	3.2	2.9	2.9	2.8	2.3
Urban	3.3	3.3	2.7	2.6	2.5	2.5	2.1
Rural	3.9	3.9	3.8	3.5	3.3	3.2	2.8

TABLE 12 (continued)

Province	Births per 1,000 Women, 15-49						
	1971	1972	1973	1974	1975	1976	1977
Camaguey							
Total	3.9	3.8	3.2	3.1	2.8	2.8	2.5
Urban	3.7	3.5	2.8	2.8	2.8	2.8	2.3
Rural	4.6	4.6	4.3	4.0	3.8	3.1	2.8
Las Tunas							
Total	4.1	4.1	3.8	3.4	3.3	3.1	2.8
Urban	3.4	3.3	3.1	2.6	2.6	2.6	2.4
Rural	4.7	4.6	4.3	4.0	3.8	3.5	3.0
Holguin							
Total	5.3	4.8	4.4	3.7	3.4	3.3	2.7
Urban	4.2	4.1	3.7	2.9	2.9	2.7	2.4
Rural	6.4	5.5	5.1	4.7	3.9	3.8	3.0
Granma							
Total	5.1	4.8	4.2	3.6	3.6	3.3	2.6
Urban	3.8	3.4	3.2	2.9	2.9	2.6	2.3
Rural	6.2	5.9	5.6	5.3	4.5	3.8	2.9
Santiago de Cuba							
Total	5.2	5.0	4.5	4.0	3.6	3.3	2.6
Urban	4.4	4.0	3.3	3.1	3.1	2.8	2.3
Rural	6.8	6.4	6.3	5.1	4.8	4.1	3.1
Guantanamo							
Total	4.6	4.5	4.1	3.6	3.3	3.2	2.9
Urban	3.5	3.4	2.9	2.7	2.7	2.5	2.5
Rural	5.8	5.5	5.3	4.5	4.0	3.9	3.3

Note: Based on women aged 15-49.

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 10).

TABLE 13 Percent of Women Currently in Union Who Do Not Want Additional Children, by Number of Living Children, 1979: Cuba and Selected World Fertility Survey Countries

Country	No Children	Number of Living Children		
		One	Two	Three
Cuba	41.3	42.8	86.3	92.6
Colombia	9.0	19.0	52.0	65.0
Costa Rica	5.3	13.0	35.2	58.9
Dominican Republic	3.1	10.5	33.3	54.0
Jamaica	2.9	21.3	39.0	47.5
Mexico	9.8	10.0	42.4	53.5
Panama	7.7	12.0	42.0	72.6
Paraguay	1.4	4.9	21.1	31.0
Peru	6.3	19.9	48.2	62.2
Venezuela	8.9	10.0	41.1	64.1
Czechoslovakia	19.7	46.2	89.8	96.6
Japan	20.4	43.9	89.2	96.6 (3+)
Spain	8.7	28.5	65.1	77.8

Note: Data for Cuba refer to all women currently in union; for all other countries, the data refer to fecund women.

Sources: All countries except Cuba: World Fertility Survey First Country Reports (various years). For Cuba: Comite Estatal de Estadisticas (1981b:Table 26).

in fertility expectations (see Figure 11). To illustrate, among women aged 20-24 in union, mean expected family size is 2.0: 2.4 among those with incomplete primary education and ranging from 2.1 to 1.6 among those in higher educational categories. Among women aged 25-29 in union, the mean expected family size is 2.4: 3.1 among those with incomplete primary education and from 2.4 to 1.8 in higher educational groups.

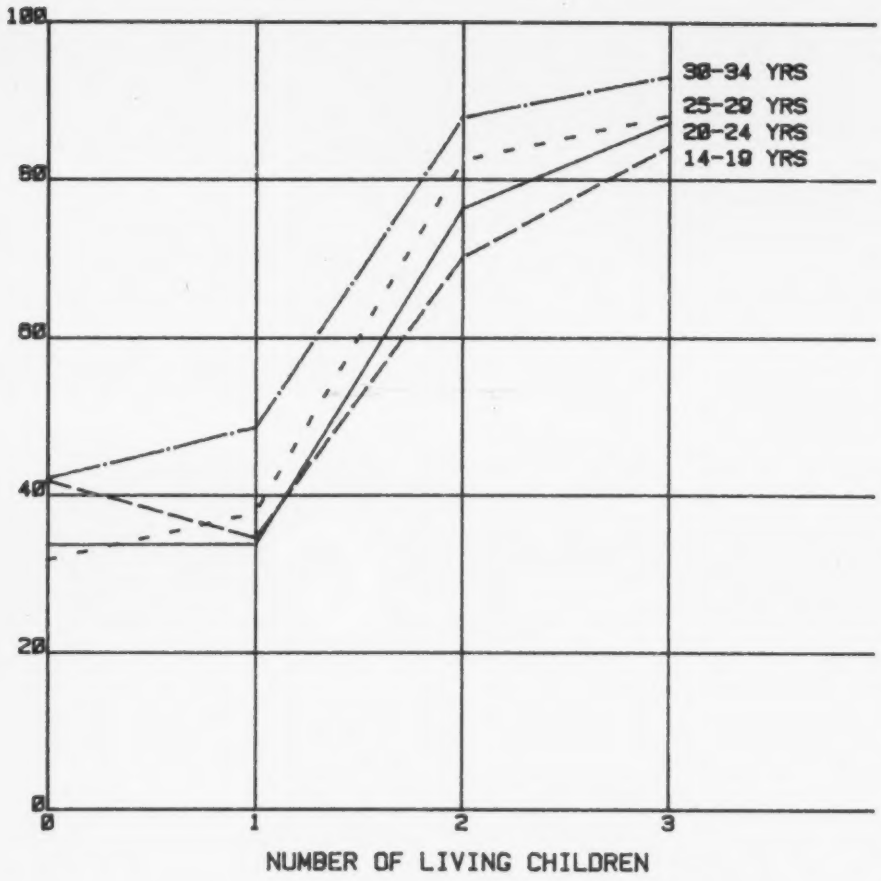

FIGURE 10 Percent of Currently Mated Women Who Want No More Children, by Number of Living Children and Age, 1979: Cuba

These low fertility expectations, especially among younger women, indicate that Cuba's current low fertility can be expected to continue, at least in the immediate future. Among women aged 15-19 in union, the mean expected family size was 1.5 children and about 2 children among women aged 20-24. In comparison, the total fertility rate at that time was 1.8. Among older women in union, aged 40-44, who were completing their childbearing, the mean number of children was much higher, approximately 3.8 children. Data on the fertility expectations of women in legal and consensual unions offer further support for these trends and are reviewed in the following chapter.

TABLE 14 Percent of Women Currently in Union Aged 14-34 Who Do Not Want Additional Children, by Number of Living Children, Age, and Rural-Urban Residence, 1979: Cuba

Number of Living Children and Age Group	Total	Urban Residence	Rural Residence
No Living Children			
14-19	41.8	39.9	44.4
20-24	33.7	33.4	34.7
25-29	31.8	29.5	39.3
30-34	42.1	39.8	48.8
One Living Child			
14-19	34.6	37.1	32.0
20-24	33.8	35.7	30.3
25-29	37.8	39.6	32.3
30-34	48.6	49.3	45.9
Two Living Children			
14-19	70.2	78.6	65.7
20-24	76.4	79.5	73.4
25-29	82.5	84.7	78.3
30-34	87.9	88.9	84.9
Three Living Children			
14-19	84.3	100.0	77.3
20-24	87.3	90.0	85.6
25-29	88.2	91.0	84.8
30-34	93.2	93.6	92.6

Source: Comite Estatal de Estadisticas (1981b:Table 27).

TABLE 15 Average Number of Live Births, Living Children, and Additional Children Desired Among Women in Union Aged 14-44, by Age and Educational Attainment, 1979: Cuba

Educational Attainment	Age Group					
	14-19	20-24	25-29	30-34	35-39	40-44
Number of Live Births per Woman						
Total[a]	0.57	1.37	2.10	2.85	3.43	3.92
Incomplete primary	0.91	2.00	2.87	3.61	4.04	4.46
Complete primary	0.67	1.57	2.16	2.66	3.05	3.25
Lower intermediate	0.44	1.13	1.74	2.20	2.49	2.58
Upper intermediate	0.29	0.80	1.35	1.89	2.08	2.26
University	0.06	0.39	0.94	1.48	1.50	1.95
Number of Living Children per Woman						
Total[a]	0.55	1.32	2.02	2.75	3.28	3.71
Incomplete primary	0.88	1.90	2.76	3.46	3.83	4.23
Complete primary	0.65	1.51	2.09	2.56	2.94	3.10
Lower intermediate	0.43	1.11	1.69	2.12	2.41	2.47
Upper intermediate	0.27	0.78	1.30	1.84	2.02	2.16
University	0.06	0.39	0.91	1.43	1.47	1.95
Additional Number of Children Desired						
Total[a]	0.96	0.66	0.41	0.23	0.16	0.08
Incomplete primary	0.90	0.53	0.30	0.17	0.14	0.07
Complete primary	1.07	0.58	0.35	0.21	0.15	0.07
Lower intermediate	0.91	0.69	0.44	0.26	0.20	0.13
Upper intermediate	1.02	0.83	0.58	0.36	0.24	0.12
University	1.02	1.21	0.86	0.50	0.50	0.10

[a]Incomplete primary includes women with no education. Lower and upper intermediate schooling and university schooling includes at least one year in the corresponding level.

Source: Comite Estatal de Estadisticas (1981b:Table 33).

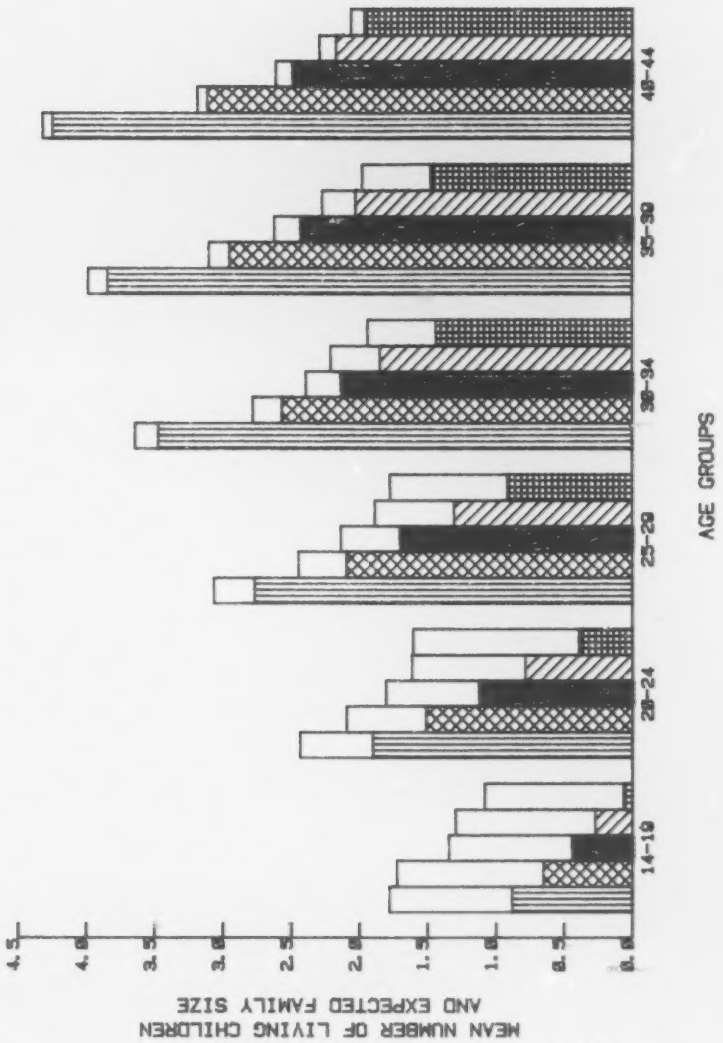

FIGURE 11 Mean Number of Living Children and Expected Family Size Among Women in Union Aged 14-44, by Educational Attainment, 1979: Cuba

CHAPTER 3

THE PROXIMATE DETERMINANTS OF FERTILITY

NUPTIALITY

Trends

Marital fertility is affected by a variety of factors relating to nuptiality: the average age at first union; and marital status, or the proportion of women in union, which is in turn influenced by the age composition of the population, as well as the incidence of widowhood, divorce, and remarriage. A distinctive feature of nuptiality in Latin America is the prevalence of consensual unions in addition to legal marriages through either civil or religious ceremonies. The consensual/legal distinction in Cuba is complicated by government campaigns, most active during 1960-61 and 1965, to formalize consensual unions through a series of laws termed Operacion Familia. Although the prevalence of consensual union declined somewhat during the 1970s, it remains a relatively popular practice. Legal marriage has also been weakened by laws liberalizing divorce, described in a later section, that have facilitated divorce and remarriage.

Data pertaining to Cuban age-specific marital fertility and socioeconomic differentials in age at marriage are lacking. Despite these limitations, trends in age at union and marital status can be ascertained from the censuses of 1953 and 1970, as well as from the 1979 National Demographic Survey and annual vital statistics on marriage rates. These data show the impact on fertility change of shifts in marital status and of government policies pertaining to marriage and divorce. Data on social characteristics and fertility differentials for

women in consensual and legal unions are also available from the 1979 National Demographic Survey.

From 1953 to 1970, both the singulate mean age at marriage and the mean age at legal marriage declined, and total marriage rates rose. Trends in marital status for Cuban males and females aged 15-49 show a decline in the proportions single and an increase in the proportions in union. By 1979, the number of men and women of reproductive age had increased because of the aging of the baby boom cohort. However, during the 1970s, the singulate mean age at marriage rose, while the proportion of women of reproductive age in union declined. Trends in age at marriage and marital status are discussed in the subsections below.

Trends in Age at Marriage

The singulate mean age at marriage declined approximately 2.5 years between 1953 and 1970 for both males and females (Table 16). By 1970, the mean age at marriage was 23.4 years for males and 19.5 years for females. As shown in

TABLE 16 Current Marital Status and Singulate Mean Age at Marriage, by Sex, 1953, 1970, 1979: Cuba

	Female			Male		
Marital Status[a]	1953	1970	1979	1953	1970	1979
Single	30.4	22.2	19.6	42.5	34.9	31.7
Married	38.8	42.9	44.3	36.1	40.2	43.0
Consensual Union	21.3	23.0	19.1	18.2	20.9	18.7
Widowed	7.8	7.1	7.5	2.5	2.0	2.1
Separated	--	--	3.7	--	--	1.9
Divorced	1.7	4.8	5.8	0.7	2.0	2.7
Singulate Mean Age at Marriage[b]	22.0	19.5	20.2	26.0	23.4	23.9

[a]Population age 15 and above.
[b]Calculation based on 1953 and 1970 census data and 1979 National Demographic Survey data.

Sources: Republica de Cuba (1955:Table 30); Republica de Cuba (1975:Table 11); Comite Estatal de Estadisticas (1981c:Table 4).

Table 17, there were also declines in the mean age at time of legalization of union for both males and females from 1960 to 1971, the last year of published data. By 1971, the mean age at legal marriage was 26.1 years for women and 30.3 years for men. These figures include couples who were legalizing previous consensual unions and remarriages among those formerly divorced or widowed, as well as those entering a union for the first time.

The overall trend toward earlier marriage as of the early 1970s may be partially attributable to the redistribution of income; a decrease in the cost of living, especially in health, education, and housing; and increased economic security due to higher employment rates, which reduce the demand for economic self-sufficiency prior to marriage (JUCEPLAN, D.C.E., 1977). Data on economic status at the time of legalization of union for the 1960s show that nearly all men (95 to 97 percent) were employed at the time of legalization of union, although more detailed data on occupational status are not available. Access to coeducational boarding schools and the creation of mass organizations for political participation have also increased opportunities for socializing, thereby promoting earlier marriage. For instance, female students constituted 1.9 percent of the women legalizing unions in 1965, rising somewhat to 4.3 percent in 1971. Finally, as noted above, laws and government campaigns designed to promote the legalization of consensual union are also responsible for peaks in marriage rates (JUCEPLAN, D.C.E., 1977).[10]

Between 1970 and 1979, a trend toward postponement of unions was evident. The mean age at marriage, based on 1970 census data and the 1979 National Demographic Survey, increased .5 years, from 23.4 to 23.9, for males, and .7, from 19.5 to 20.2, for females. Differences in the mean age at marriage for men and women narrowed somewhat, from 4 years in 1953 to 3.9 years in 1970 and 3.7 years in 1979 (Table 16). This trend toward postponement of marriage in the late 1970s is probably attributable to the expansion of secondary education, the housing shortage in urban areas, and perhaps the increased availability of contraception. Other temporary contributory factors include compulsory military conscription for males, Cuban activities overseas, and the operation of a marriage squeeze, that is, a shortage of males aged 20-24 for females aged 15-19 due to the aging of the baby boom cohort. These various factors are discussed in detail below.

TABLE 17 Total and Ordinary Marriage Rates and Mean Age at Legal Marriage, 1955-80: Cuba

Year	Crude Total Marriage Rate[a]	Ordinary Marriage Rate[b]	Mean Legal Age at Marriage	
			Male	Female
1955	4.4	--	--	--
1956	4.4	--	30.5	25.4
1957	4.6	--	--	--
1958	4.5	--	--	--
1959	4.6	4.6	--	--
1960[c]	9.2	5.6	33.1	28.0
1961[c]	10.3	7.6	31.7	27.0
1962	8.3	7.1	30.3	25.9
1963	7.6	7.5	28.5	24.4
1964	6.1	6.0	29.1	25.0
1965[c]	8.9	6.6	31.2	26.7
1966	6.0	6.0	29.4	25.3
1967	6.4	6.3	29.8	25.7
1968	10.2	9.2	30.1	26.0
1969	10.2	9.7	29.6	25.5
1970	13.4	10.7	30.7	26.5
1971	13.0	11.3	30.3	26.1
1972	8.8	7.7	--	--
1973	7.0	6.1	--	--
1974	7.3	--	--	--
1975	7.0	--	--	--
1976	6.5	--	--	--
1977	6.5	--	--	--
1978	6.2	--	--	--
1979	6.7	--	--	--
1980	7.0	--	--	--

Note: -- indicates data unavailable.

[a]Number of marriages per 1,000 mid-year population. Figures include legal ordinary marriages and formalized consensual unions.
[b]Number of marriages, excluding formalization of consensual unions, per 1,000 mid-year population.
[c]Concerted governmental efforts to promote the legal formalization of consensual unions during these years.

Sources: 1955-71 figures: JUCEPLAN, D.C.E. (1977:Tables 1 and 3). 1972-75 figures: JUCEPLAN, D.C.E. (1975:Table 10); Comite Estatal de Estadisticas and CELADE (1981). 1976-80 figures: Comite Estatal de Estadisticas (1980:Table 46; 1982:Table 8).

Age at union has a clear relationship to fertility trends. The shifts in Cuban age at union described here underlie the trend toward earlier childbearing and an increase in age-specific fertility recorded among women aged 15-19 between the late 1950s and early 1970s, as well as the subsequent decline during the latter part of the decade.

Trends in Marital Status

Paralleling these shifts in age at marriage, the proportion of women in union shifted between the prerevolutionary and postrevolutionary period. Annual data on total marriage rates (including the legalization of consensual unions) are available for 1955-80, as shown in Table 17. Prior to the revolution, these rates were constant--approximately 4.5 marriages per 1,000 population from 1955 to 1958. The somewhat higher rates recorded for 1960-61 reflect the influence of Operacion Familia. Marriage rates doubled in the immediate postrevolutionary period and then declined slowly until 1968-71, when they again rose. Since 1972, total marriage rates, like fertility rates, have declined: by 1980, the marriage rate had declined to 7.0 per 1,000 population from levels higher than 13 in the early 1970s.

Data on ordinary marriage rates (excluding the legalization of consensual unions) show a pronounced increase during the immediate postrevolutionary years 1960-63 and a second peak from 1968 to 1971, although marriage rates for the years 1970-71 are somewhat inflated by higher rates of remarriage following divorce. Interestingly, these peaks in ordinary marriage rates are concomitant with periods of emigration from Cuba; the resulting increase in the housing supply encourages marriages postponed because of an inability to establish a separate household (see Figure 12). The peaks in marriage rates may also be partly attributable to marriages promoted by mass mobilizations of the population for the 1961 literacy campaign and the 1970 sugarcane harvest. During the 1961 literacy campaign, for instance, volunteers, primarily teenagers, were mobilized to teach literacy in the rural areas; similarly, mobilization of adult men and women for the 1970 sugarcane harvest (reportedly involving 150,000 to 235,000 volunteers) may account in part for the modest rise in fertility in 1971, representing a postponement of 1970 births.

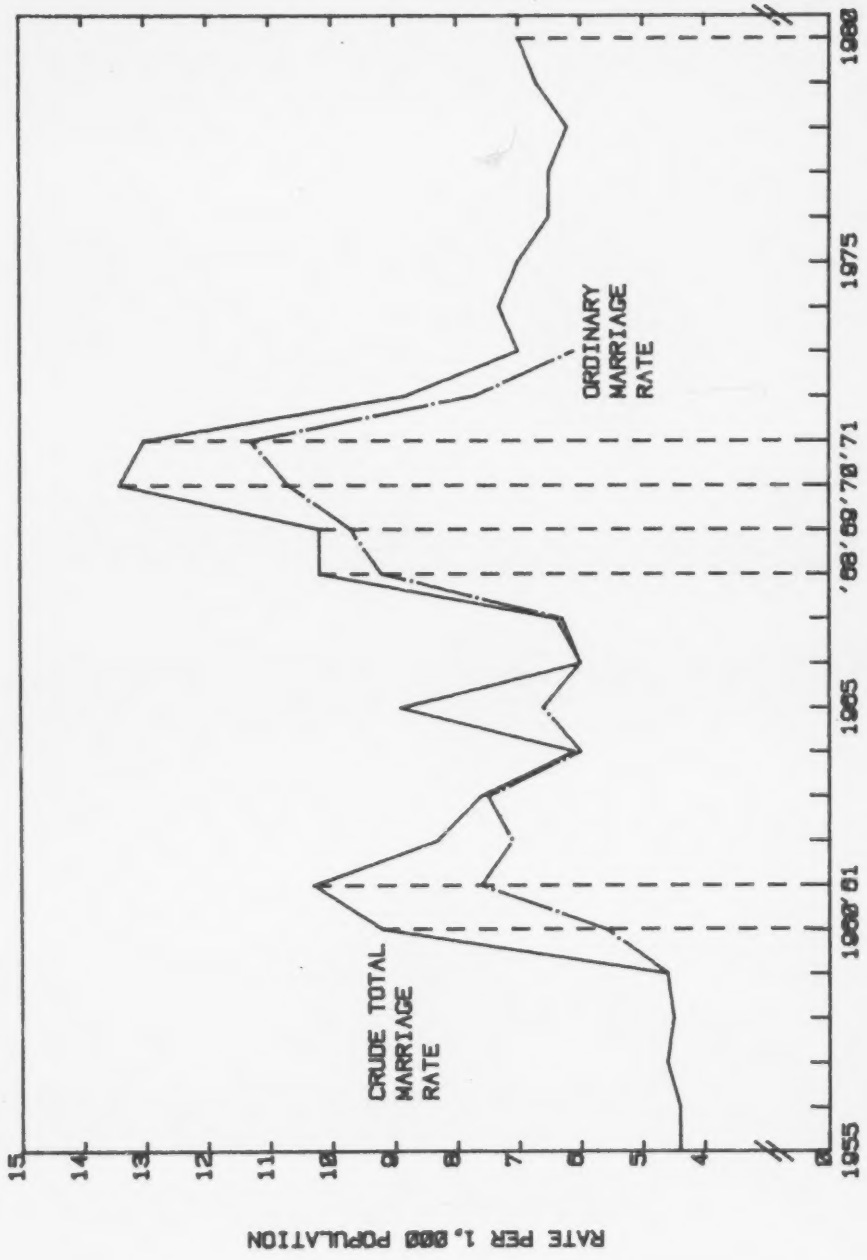

FIGURE 12 Marriage Rates and Peak Periods of Emigration, 1955-80: Cuba

TABLE 18 Age-Specific Total Marriage Rates, by Age of Mother and Year, 1956-71[a]: Cuba

Year	Age of Mother				
	15-19	20-24	25-29	30-34	35-39
1956	23.0	31.0	20.7	12.0	7.0
1960	38.9	57.9	40.4	30.9	23.2
1961	52.4	69.7	43.4	30.8	22.4
1962	50.5	58.0	33.0	21.8	15.8
1963	53.5	55.1	28.7	16.4	11.1
1964	43.3	41.9	24.5	14.7	10.1
1965	50.1	56.4	39.5	26.8	21.1
1966	40.1	41.4	24.4	15.2	11.0
1967	42.8	46.2	25.8	16.0	11.2
1968	65.4	73.3	43.3	27.7	21.1
1969	73.3	72.7	39.9	25.6	19.3
1970	88.1	87.5	53.8	39.7	31.2
1971	92.8	83.5	49.1	36.1	28.5

[a]Number of marriages per 1,000 mid-year female population in specific age groups. Figures include legal ordinary marriages and formalized consensual unions.

Source: JUCEPLAN, D.C.E. (1977:Table 9).

Age-specific total marriage rates for women 15-39, reported in Table 18, show an increase in the incidence of marriage within all age groups during the years of Operacion Familia (1960-61 and 1965). The second surge in marriage rates from 1968 to 1971 is similarly evident within all age groups. Especially marked, however, is the increase in marriage among women aged 15-19 and 20-24 underlying the trend toward earlier childbearing.

More detailed information on marital status by age group is provided for both men and women in Tables 16 and 19.[11] As noted in Table 16, between 1953 and 1970 the proportion of males age 15 and above living in union increased from 54 percent to 61 percent; the proportion for females increased from 60 percent to 66 percent. The proportion of widowed individuals declined slightly between 1953 and 1970, probably because of the dispropor-

TABLE 19 Marital Status Distribution, by Sex and Age Group, 1953, 1970, 1979: Cuba

	Female			Male		
Age Group	1953	1970	1979	1953	1970	1979
Proportions Single						
12-14	98.9	98.1	95.1	99.3	99.8	97.6
15-19	79.5	70.4	75.6	97.8	95.4	93.3
20-24	45.0	29.6	28.2	78.2	62.7	61.1
25-29	26.8	14.0	10.0	47.4	28.4	29.3
30-34	18.1	10.1	4.7	29.2	17.3	13.8
35-39	14.6	9.3	4.3	21.1	14.6	9.8
40-44	12.6	9.5	4.6	18.0	14.2	7.8
45-49	12.3	10.1	3.7	17.6	14.8	8.4
15-49	34.7	25.8	24.5	49.3	41.6	40.2
Proportions Married						
12-14	.5	.9	2.6	.5	.1	2.3
15-19	8.4	16.4	10.3	1.0	2.6	4.1
20-24	27.4	40.6	39.7	10.3	23.5	19.7
25-29	41.9	50.0	56.1	29.3	45.2	43.0
30-34	49.5	52.8	57.5	42.6	51.0	57.8
35-39	52.4	52.7	58.6	47.7	51.5	59.0
40-44	55.7	53.0	57.9	52.3	52.6	60.5
45-49	56.2	52.5	58.4	56.1	52.6	60.0
15-49	38.0	43.1	44.5	30.7	36.1	37.9
Proportions in Consensual Union						
12-14	.5	.9	1.8	.2	.1	.0
15-19	11.8	11.5	10.7	1.1	1.9	2.2
20-24	26.4	24.9	21.9	11.2	12.5	16.0
25-29	29.1	29.3	22.2	22.6	23.8	21.6
30-34	28.9	30.4	24.8	27.1	28.9	22.1
35-39	28.0	30.8	24.9	29.7	30.9	25.5
40-44	24.2	29.0	24.5	27.7	29.9	25.3
44-49	20.1	27.0	23.1	23.6	28.9	25.6
15-49	23.7	25.1	20.7	19.0	20.2	17.6

TABLE 19 (continued)

Age Group	Female 1953	Female 1970	Female 1979	Male 1953	Male 1970	Male 1979
Proportions Divorced and Separated						
12-14	.0	.1	.5	.0	.0	.1
15-19	.2	1.5	3.3	.0	.1	.3
20-24	.8	4.6	10.0	.2	1.2	3.1
25-29	1.6	6.2	11.3	.5	2.5	5.9
30-34	2.2	5.9	12.1	.7	2.6	6.1
35-39	2.6	5.8	11.0	.9	2.6	5.5
40-44	2.8	5.8	10.9	1.0	2.6	5.9
45-49	2.7	5.6	10.7	.9	2.7	5.2
15-49	1.6	4.8	9.3	.5	1.8	4.1
Proportions Widowed						
12-14	.1	.0	.0	.0	.0	.0
15-19	.1	.1	.0	.1	.0	.0
20-24	.3	.3	.2	.1	.1	.1
25-29	.6	.5	.4	.2	.1	.2
30-34	1.3	.8	.9	.4	.2	.2
35-39	2.4	1.5	1.3	.6	.4	.2
40-44	4.7	2.7	2.1	1.0	.6	.5
45-49	8.7	4.8	4.0	1.8	1.0	.8
15-49	2.0	1.2	1.0	.5	.3	.2

Sources: Republica de Cuba (1955:Table 30, 1975:Table 11); Comite Estatal de Estadisticas (1981c:Table 4).

tionate emigration of the elderly. A rise in the proportion of divorced and separated individuals is also evident, especially among women. Data on the population of reproductive age shown in Table 19 also reveal an increase in the proportion of males and females in union between 1953 and 1970 in part due to changes in reporting procedures and probable influence of the immigration of middle- and upper-middle class women from Cuba during the early 1960s. By 1970, 56 percent of all men and 68 percent of all women of reproductive age were in union. This increase is primarily attributable to a sharp increase in the proportions of married men and women aged 15-34, especially women aged 15-29; this is the same age

group in which total marriage rates are highest. There was a less significant increase in the proportions living in consensual unions among those aged 35-49; among those aged 15-34, the proportions in consensual union changed little between 1953 and 1970.[12]

Between 1970 and 1979, as previously noted, the singulate mean age at marriage rose, and total marriage rates declined. Although the number of men and women entering reproductive age increased because of the aging of the baby boom cohort, the proportion of the population age 15 and above currently in union declined somewhat. As noted in Table 16, 63 percent of women and 62 percent of men aged 15 and above reported they were currently in union in 1979, in comparison to 66 percent of the women and 61 percent of the men in 1970. Table 19 shows that 65 percent of women and 56 percent of men aged 15-49 were in union in 1979. The proportions of men and women living in consensual union decreased in all age groups, while the proportions married increased among those aged 25-49. The proportion of women aged 15-19 who were single also increased.

An important component of the study of marriage status and fertility in Cuba is the type of union, consensual or legal. Data on the association between marital status and fertility are available through basic tabulations from the 1979 National Demographic Survey, which provide information on the mean number of live births, surviving births, and additional number of desired children among women aged 14-49 in consensual union or in legal marriage at the time of the survey.[13] It may be noted here that government efforts undertaken to encourage the formalization of consensual unions through Operacion Familia have had a small effect on the reduction of consensual unions over time perhaps due to the assumption by the state of many family functions. Despite these efforts, consensual union has remained popular, especially among older women. In 1979, 20.7 percent of all women aged 15-49 were in consensual union, in comparison to 23.7 percent in 1953 (Table 19). Among all women in union aged 15-49, 31.8 percent reported consensual unions in 1979, in comparison to 38.4 percent in 1953 (Table 22 below).

Although women of reproductive age living in consensual union have higher fertility than those in legal unions, this association is complicated by underlying relationships between marital status and place of residence, age at union, and educational attainment. The prevalence of consensual union is higher in rural than in urban areas:

TABLE 20 Educational Attainment of Women in Union Aged 14-49, by Current Marital Status, 1979: Cuba

Education	Total	Marital Status	
		Married	Consensual Union
Incomplete Primary	32.8	26.9	45.3
Complete Primary	26.4	27.6	23.8
Lower Intermediate	21.9	25.2	14.6
Upper Intermediate	10.3	13.6	3.1
University	3.3	3.3	.3
Unclassified	6.3	3.4	12.9

Source: Comite Estatal de Estadisticas (1981b:Table 17).

among women aged 14-49, nearly one-third of those in rural areas were living in consensual unions at the time of the National Demographic Survey, as compared to only 13 percent of those in urban areas. As shown in Table 20, nearly half of the women in consensual unions had not completed primary school, in comparison with one-fourth of those in legal unions. Moreover, like women in other Latin American nations, Cuban women begin consensual unions at younger ages than they do legal unions: as noted in Table 21, three-quarters of those living in consensual union in 1979 reported having begun their first union between the ages of 14 and 19, in contrast to 50 percent of those currently married and 55 percent of those who were widowed, divorced, or separated at the time of the survey.

Among women in union, 51 percent of those aged 15-19 reported living in consensual union, 36 percent of those aged 20-24, and 28-30 percent of those in older age groups up to age 49. Thus, the prevalence of consensual unions does not vary greatly among those over age 25, suggesting the possibility that consensual unions among these women are higher-order unions (Table 22). The data in Table 19 are arrayed differently; they show marital status distribution, including the proportions single, divorced, separated, and widowed in 1953, 1970, and 1979. In all three time periods, the prevalence of consensual unions shows little variation among women aged 20-49.

TABLE 21 Age at First Union for the Female Population Aged 14-49, by Current Marital Status, 1979: Cuba

Age at First Union or Marriage	Total	Current Marital Status		
		Married	Consensual Union	Widowed, Divorced, Separated
14-19	56.9	49.5	75.8	54.9
20-24	27.9	32.3	18.1	27.4
25-29	10.0	12.1	4.0	11.4
30-34	3.2	3.9	1.2	3.9
35-39	1.3	1.6	.6	1.5
40-44	.4	.5	.2	.6
45-49	.3	.3	.1	.3
Total	100.0	100.0	100.0	100.0

Source: Comite Estatal de Estadisticas (1981c:Table 12).

Table 23 and Figure 13 show that, according to the 1979 National Demographic Survey, women in consensual union have a higher mean number of surviving births than those in legal marriages, as well as higher fertility expectations. The latter, not assessed in a separate question, are calculated as the sum of the number of surviving births and the additional number of children desired by the respondent at the time of the survey. Expressed in terms of means, in urban areas, women in consensual union expected 3.4 children, as compared with 2.5 children expected by those in legal unions; the expectations of rural women in consensual and legal unions were similar (4.0 and 3.0, respectively). As shown graphically in Figure 13, within each age and marital-status group, women in rural areas have higher fertility than their urban counterparts. However, differentials in fertility and fertility expectations between women in consensual and legal unions widen as age increases, and are especially evident among older rural women; among younger women, differentials in fertility by marital status and urban-rural residence are not nearly as marked.

TABLE 22 Percent of Women in Consensual Union Among All Women in Union and Percent of Women Divorced and Separated Among All Unmated Women, by Age, 1953, 1970, 1979: Cuba

	Percent in Consensual Union Among Women in Union			Percent Divorced and Separated Among Unmated Women		
Age Group	1953	1970	1979	1953	1970	1979
15-19	58.3	41.2	51.0	.4	2.1	.5
20-24	49.1	38.0	35.6	2.6	13.4	8.7
25-29	41.0	36.9	28.4	8.3	29.8	27.0
30-34	36.8	36.6	30.1	17.2	34.9	33.3
35-39	34.8	36.9	29.8	26.1	35.0	32.0
40-44	30.3	35.4	29.7	37.4	32.3	33.7
45-49	26.3	34.0	28.3	47.4	27.5	27.0
15-49	38.4	36.9	31.8	11.2	15.2	11.8

Sources: Republica de Cuba (1955:Table 30; 1975:Table 11); Comite Estatal de Estadisticas (1981c:Table 4).

Another perspective on the association between marital status and fertility is offered in Table 24, which cross-classifies the mean number of live births and expected family size by marital status, place of residence, and women's educational attainment. These data, although not cross-classified by age group, show the expected negative relationships between educational attainment and both the number of live births and expected family size among urban and rural women living in consensual and legal unions. Within both urban and rural areas, differentials in fertility and expected family size between women in consensual and legal unions are greatest among those in the lowest educational category (incomplete primary), which includes 45 percent of women in consensual unions and 27 percent of those in legal unions. In urban areas, women living in consensual union with less than primary school completed expected 3.9 children, in comparison to 3.2 children expected by women in legal union; in rural areas, expected family size was 4.1 children among less-educated women in consensual unions, in contrast to 3.5 children among women in legal unions. Among women in other educational categories, fertility differences by marital status are negligible (see Figure 14).

TABLE 23 Mean Number of Live Births, Surviving Births, and Additional Children Desired, by Age, Current Marital Status, and Rural-Urban Residence, 1979: Cuba

Age Group	Current Marital Status: Consensual Union			Current Marital Status: Married			Difference: Consensual Union Minus Married		
	Live Births	Surviving Births	Additional Children Desired	Live Births	Surviving Births	Additional Children Desired	Live Births	Surviving Births	Additional Children Desired
Cuba									
14-19	.68	.65	1.04	.46	.45	.88	.22	.20	.16
20-24	1.70	1.63	.60	1.19	1.15	.70	.51	.48	-.10
25-29	2.80	2.68	.36	1.81	1.76	.43	.99	.92	-.07
30-34	3.81	3.64	.18	2.44	2.36	.25	1.37	1.28	-.07
35-39	4.69	4.44	.14	2.90	2.79	.17	1.79	1.65	-.03
40-44	5.35	5.00	.06	3.32	3.17	.09	2.03	1.83	-.03
45-49	5.85	5.41	--	3.46	3.29	--	2.39	2.12	--
14-49	3.52	3.32	.37	2.39	2.30	.35	1.13	1.02	.02
Urban Residence									
14-19	.56	.53	1.05	.44	.43	.90	.12	.10	.15
20-24	1.53	1.46	.62	1.05	1.02	.73	.48	.44	-.11
25-29	2.61	2.49	.35	1.69	1.64	.45	.92	.85	-.10
30-34	3.42	3.27	.27	2.28	2.20	.26	1.14	1.07	.01
35-39	4.18	3.94	.16	2.71	2.61	.18	1.47	1.33	-.02
40-44	4.58	4.24	.06	3.07	2.93	.09	1.51	1.31	-.03
45-49	4.99	4.59	--	3.11	2.96	--	1.88	2.13	--
14-49	3.20	3.01	.37	2.23	2.15	.36	.97	.86	.01

Rural Residence

14-19	.75	.73	1.03	.50	.48	.84	.25	.25	.19
20-24	1.83	1.76	.58	1.49	1.43	.65	.33	.27	-.07
25-29	2.97	2.85	.37	2.14	2.06	.39	.83	.79	-.02
30-34	4.16	3.97	.16	2.90	2.81	.21	1.26	1.16	-.05
35-39	5.20	4.94	.11	3.44	3.31	.16	1.76	1.63	-.05
40-44	6.04	5.69	.05	4.05	3.86	.07	1.99	1.83	-.02
45-49	6.68	6.20	--	4.47	4.24	--	2.21	1.96	--
14-49	3.79	3.59	.38	2.82	2.71	.34	.97	.88	.04

Note: -- indicates question on the additional number of children desired was not asked of women aged 45-49.

Source: Comite Estatal de Estadisticas (1981b:Table 25).

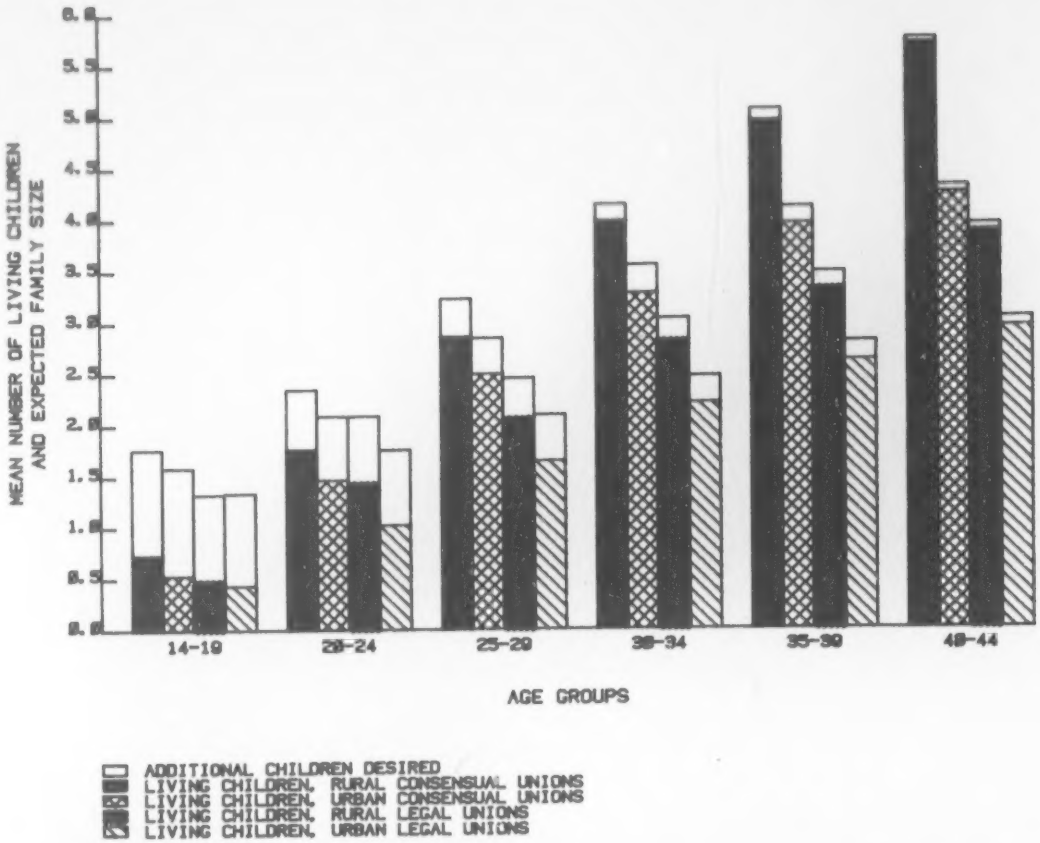

FIGURE 13 Mean Number of Living Children and Expected Family Size Among Women in Union Aged 14-44, by Current Marital Status and Rural-Urban Areas, 1979: Cuba

Divorce

As noted above, Cuban marriage rates doubled during the immediate postrevolutionary period, declined slowly until 1968, peaked in 1971, and subsequently declined. Similar trends can be seen in crude divorce rates, which rose from a prerevolutionary rate of .4 divorces per 1,000 population to a peak rate of 3.0 to 3.2 in 1971-72, with subsequent slight declines. As of 1980, the divorce rate was 2.5 (Table 25).

More precise data on divorce are presented in Tables 16, 19, and 22, which show an increase in the proportion of divorced and separated women between 1953 and 1970 and further increases between 1970 and 1979. For instance, among men and women of reproductive age, the proportions of women currently divorced and separated increased from 1.6 percent in 1953 to 4.8 percent in 1970 to 9.3 percent in 1979; for men, the increase recorded was from .5 percent in 1953 to 1.8 percent in 1970 and 4.1 percent in 1979 (Table 19). Table 22 examines the proportion among all unmated women (including those single and widowed) who were divorced or separated for 1953, 1970, and 1979. In 1953, this proportion increased by age group; by 1979, however, there was a shift toward higher divorce among younger women and relatively little difference in prevalence among women aged 25-49.

The rise in postrevolutionary divorce rates is attributable to rapid social change, the increased economic independence of women, the deleterious impact of the housing shortage, and liberalization of divorce legislation. Under the divorce statute of the Family Code Legislation, enacted in 1975, either party may take action to obtain a divorce through judicial decree on rather unrestricted grounds, that is, when the marriage has lost its meaning for the couple and their children, and thus for society as a whole (Ministry of Justice, 1975).

In general, in postrevolutionary Cuba, both marriage and divorce are more likely, and remarriage is less probable, particularly among women. Counterbalancing the higher divorce rate has been a reduction in the proportion of single women in all age groups. Nearly all Cuban women enter a union at some time during their reproductive years. As noted in Table 19, in 1979 the proportion of those single among older women ranged from 4.6 among those aged 40-44 to 3.7 percent among those aged 45-49; in contrast, in 1953, the proportions of single women

TABLE 24 Mean Number of Live Births and Expected Family Size Among Women in Union Aged 14-49, by Marital Status, Educational Attainment, and Rural-Urban Residence, 1979: Cuba

Education	Current Marital Status: Consensual Union — Live Births	Consensual Union — Expected Family Size[a]	Married — Live Births	Married — Expected Family Size[a]	Difference: Consensual Union Minus Married — Live Births	Difference: Consensual Union Minus Married — Expected Family Size[a]
Cuba						
Incomplete primary	4.00	4.02	3.31	3.33	.69	.69
Completed primary	2.68	2.95	2.44	2.60	.24	.35
Lower intermediate	1.72	2.27	1.72	2.07	.00	.20
Upper intermediate	1.38	2.06	1.49	1.92	-.11	.14
University	1.51	2.02	1.15	1.80	.36	.22
Total[b]	3.52	3.66	2.39	2.61	1.13	1.05
Urban Residence						
Incomplete primary	3.91	3.87	3.24	3.23	.67	.64
Completed primary	2.83	2.99	2.48	2.59	.35	.40
Lower intermediate	1.82	2.30	1.74	2.07	.08	.23
Upper intermediate	1.38	2.04	1.50	1.92	-.12	.12
University	1.56	2.03	1.15	1.80	.41	.23
Total[b]	3.20	3.33	2.23	2.46	.97	.87

Rural Residence						
Incomplete primary	4.06	4.12	3.40	3.45	.66	.67
Completed primary	2.52	2.92	2.36	2.61	.16	.31
Lower intermediate	1.54	2.20	1.58	2.05	-.04	.15
Upper intermediate	1.37	2.09	1.40	1.93	-.03	.16
University	.59	1.82	1.08	1.88	-.49	-.06
Total[1]	3.79	3.93	2.82	3.01	.97	.92

[a]Expected family size is defined as the sum of the number of surviving births plus the additional number of children desired by the respondent at the time of the interview. Question on the additional number of children desired was not asked of women aged 45-49.

[b]Total figures include women with undeclared educational attainment. Those categorized as having incomplete primary education include women with no education. Lower intermediate, upper intermediate, and university education include women with at least one year of education in the corresponding educational levels.

Source: Comite Estatal de Estadisticas (1981b:Table 32).

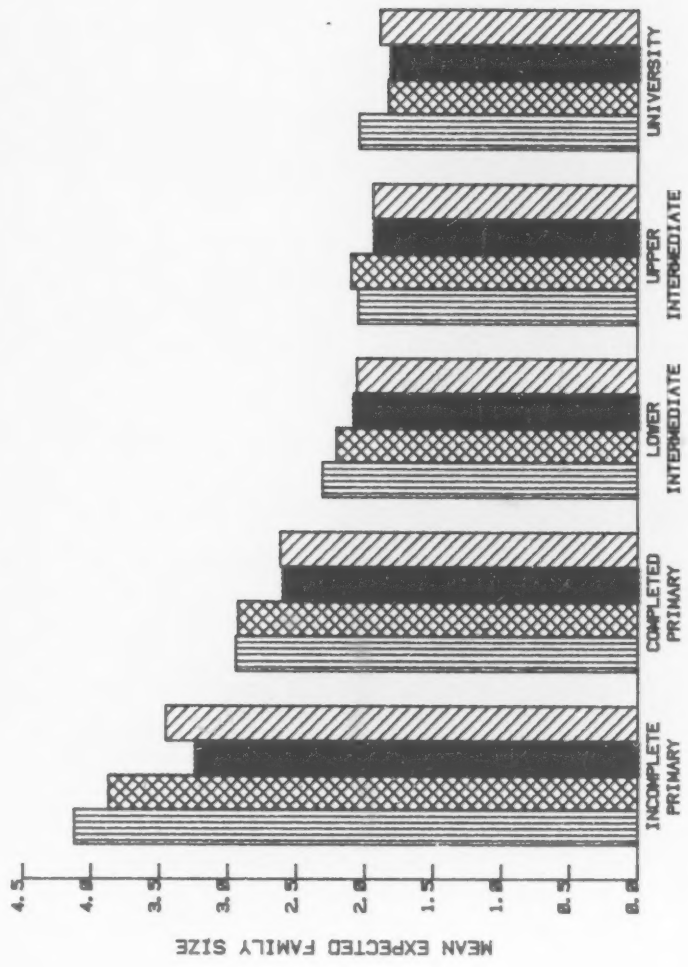

FIGURE 14 Mean Expected Family Size Among Women in Union Aged 14-44, by Current Marital Status, Educational Attainment, and Rural-Urban Areas, 1979: Cuba

TABLE 25 Crude Divorce Rates[a], 1955-80: Cuba

Year	Crude Divorce Rate	Year	Crude Divorce Rate
1955	.4	1968	1.8
1956	.4	1969	2.4
1957	.4	1970	2.9
1958	.4	1971	3.2
1959	.4	1972	2.9
1960	.5	1973	2.7
1961	.6	1974	2.2
1962	.8	1975	2.4
1963	1.0	1976	2.3
1964	1.0	1977	2.4
1965	1.1	1978	2.6
1966	1.2	1979	2.6
1967	1.4	1980	2.5

[a]Number of divorces per 1,000 mid-year population.

Sources: 1955-71 figures: JUCEPLAN, D.C.E. (1977:Table 1). 1972-75 figures: JUCEPLAN, D.C.E. (1975:Table 10); Comite Estatal de Estadisticas and CELADE (1981). 1976-80 figures: Comite Estatal de Estadisticas (1980:Table 46; 1982:Table 8).

were much higher--12.6 percent among those aged 40-44 and 12.3 percent among those aged 45-49. Rates of remarriage among ever-divorced men and women aged 15-49 show that men are far more likely than women to remarry. Although the prevalence of divorce increased within every age group between 1953 and 1979, the proportions currently divorced are higher among women than among men in all age groups, suggesting a lower probability of remarriage among women.

The mean age at first divorce among women declined from 29.5 years in 1964 to 27.8 years in 1971; for men, there was a decline from 34.6 to 31.7 (JUCEPLAN, D.C.E., 1976). Although there are no published data available on parity of couples at the time of divorce, it appears that the rising divorce rate has not been an important factor

TABLE 26 Percent of Childless, Divorced Couples, by Marital Duration and Year of Divorce, 1962-63 and 1969-71: Cuba

Marital Duration	1962	1963	1969	1970	1971
0-6 months	78.7	77.2	87.8	92.1	92.2
6-11 months	78.9	77.9	87.7	88.1	87.5
1 year	66.5	64.5	64.0	65.0	64.1
2 years	48.0	42.0	44.3	41.0	39.6
3 years	42.5	36.5	30.3	28.4	29.4
4 years	35.8	39.6	25.2	25.7	25.0
5 years	36.5	29.5	18.6	20.5	21.2
6 years	36.3	33.2	18.0	16.5	16.8
7 years	26.8	27.4	16.8	15.3	17.0
8 years	27.0	25.1	15.1	12.5	14.3
9 years	22.7	23.3	15.9	13.8	13.7
10-14 years	23.0	23.6	18.1	15.7	14.6
15-19 years	22.0	21.6	21.6	14.8	16.3
20+ years	23.3	22.1	26.4	21.7	23.0

Source: JUCEPLAN, D.C.E. (1976:Table 19).

in fertility decline. Table 26 provides some data on the proportion of childless couples among individuals granted divorces in selected years from 1962-71. These data suggest that childlessness among couples requesting divorce after less than a year of marriage was more frequent in the early 1970s (when divorce rates were highest) than in the early 1960s. Comparing these two periods, among couples married 2 or more years who subsequently divorced, there is a reduction in the proportion childless, indicating that children were less of an obstacle to divorce in the early 1970s than in the early 1960s (JUCEPLAN, D.C.E., 1976). No later data have been published that would indicate the association between divorce and number of children during the later 1970s, following enactment of the 1975 Family Code.[14]

The Effect of Cohort Size on Nuptiality

As noted earlier, data on marital status by sex and age for Cuba between 1953 and 1979 show shifts in the proportion of men and women in union, especially among the younger cohorts. The changing size of successive

cohorts and differences in the mean age at marriage for males and females appear to have produced a marriage squeeze that is probably associated with shifts in female marital status between 1970 and 1979 and with the rapid fertility decline recorded in the late 1970s. This is especially true for younger women aged 15-19 and 20-24 who experienced sharp declines in age-specific fertility rates between 1976 and 1980 (37 percent and 35 percent, respectively). Estimated singulate mean ages at marriage for males and females in Cuba, obtained from the latest available 1970 census data, differ by about 4 years (19.5 years of age for females and 23.4 years for males). It is therefore possible to determine roughly whether differences in the size of the successive cohorts produced by the baby boom of the early 1960s have produced a marriage squeeze. This has been done, based on age-sex estimates of the Cuban population, through a comparison of the sex ratios derived from relating the male population in five-year age groups to the female population in the preceding five-year age groups during the prime marriage ages (15-29 for females).

The results of these computations, with the estimated age structures for 1970, 1975, and 1980, are shown in Table 27. As the table shows, the earlier trends in these sex ratios with increasing age are consistent with what might be expected given the conventional tapering off with age of a population pyramid (see Figure 3) and higher male mortality since birth. By 1980, however, the sex ratio for women aged 15-19 and men aged 20-24 deviates significantly from the expected pattern: at these ages, there are only approximately 72 men for every 100 women. The 1980 sex ratio obtained by relating women aged 15-24 to men 20-29 also reflects this sex imbalance.

Table 28 provides additional data on sex ratios of males 20-24 per 100 females 15-19, by province, using the latest available 1979 data. As noted in the table, sex ratios recorded in the provinces are low but do not differ greatly from the 1979 national average (70.4), ranging from a low of 64 males 20-24 per 100 females 15-19 in Ciudad de la Habana to a high of 77 males in Holguin. The only exception is noted in Isla de la Juventud, an island off the southwest coast of Cuba used for the education of Cuban and international scholarship students from Africa and Central America, ranging in age from 12 to 18: in 1979, Isla de la Juventud had an extremely high sex ratio of 156.

TABLE 27 Sex Ratios of the Population in Prime Marriage Ages, 1970-90: Cuba

All Marital Statuses	1970	1975	1979	1980	1985	1990
Males 20-24/Females 15-19	96.8	97.5		71.5	100.3	112.4
Males 25-29/Females 20-24	93.3	96.4		97.2	70.4	100.1
Males 30-34/Females 25-29	89.7	92.5		96.9	98.2	70.1
Males 20-29/Females 15-24	95.1	97.0		82.0	85.7	106.0
Males 20-29/Females 15-24 with adjustments for assumed number of males serving abroad temporarily[a]	--	--		77.7	--	--
Single, Divorced, Separated, and Widowed						
Males 20-24/Females 15-19	84.9		57.2			
Males 25-29/Females 20-24	83.6		91.4			
Males 30-34/Females 25-29	87.1		88.3			
Males 20-29/Females 15-24	84.5		65.5			

[a]Assumed to be 40,000 and all in ages 20-29.

Sources: For all marital statuses: Comite Estatal de Estadisticas and CELADE (1980b:Table 9). For single, divorced, separated, and widowed: Republica de Cuba (1975:Table 11); Comite Estatal de Estadisticas (1981c:Table 4).

The bottom panel of Table 27 illustrates an alternative measure of the marriage squeeze: the ratio of unmarried men of marriage age to unmarried women of marriage age, based on marital status distributions from the 1970 census and the 1979 National Demographic Survey. Ratios below unity indicate an increase in unmarried women (single, divorced, separated, and widowed). There is relatively little difference in the sex ratios in 1970 among the various age groups. By 1979, however, there is a sharp decline to 57 unmarried males aged 20-24 per 100 unmarried females aged 15-19; the 1979 sex ratio obtained by relating unmarried females aged 15-24 to unmarried males 20-29 also reflects this sex imbalance.

TABLE 28 Sex Ratios by Provincial Division for all Ages and for Prime Marriage Ages, 1979: Cuba

	Birth Rate	All Ages	All Males 20-24/ Females 15-19	Unmarried Males 20-24/ Females 15-19	All Males 20-29/ Females 15-24	Unmarried Males 20-29/Unmarried Females 15-24
Cuba	14.7	103.6	70.4	57.2	84.1	65.5
Pinar del Rio	16.6	108.2	72.8	63.1	87.7	71.9
La Habana	12.8	106.0	70.0	59.5	86.1	69.8
Ciudad de la Habana	11.4	94.8	64.4	50.9	81.1	62.2
Matanzas	12.6	105.7	68.5	62.0	86.7	70.2
Villa Clara	13.1	104.7	66.2	51.8	83.1	61.3
Cienfuegos	13.9	105.5	67.1	66.0	83.3	76.6
Sancti Spiritus	12.7	106.9	70.6	63.5	85.6	71.5
Ciego de Avila	15.5	109.8	73.7	61.1	87.5	71.5
Camaguey	15.4	106.9	68.5	53.1	84.6	63.3
Las Tunas	16.6	108.5	76.7	48.3	89.0	56.6
Holguin	15.4	105.7	74.6	63.6	85.7	68.6
Granma	18.5	105.6	73.4	57.1	81.0	64.4
Santiago de Cuba	17.2	102.7	74.5	61.3	82.9	65.4
Guantanamo	19.7	105.2	75.9	60.3	81.5	62.7
Isla de la Juventud	19.7	110.5	156.3	59.0	99.4	62.1

Sources: For all marital statuses: Comite Estatal de Estadisticas (1980:Tables 20 and 9). For single, divorced, widowed, and separated: Comite Estatal de Estadisticas (1981c:Table 4).

Table 28 illustrates this second measure of the marriage squeeze by province, indicating a range in sex ratios from a low of 48 in the eastern province of Las Tunas to 66 in the central province of Cienfuegos. With the exception of these two provinces, there is little variation from the ratio calculated for all of Cuba (57 unmarried males 20-24 per 100 females 15-19). Provincial ratios of unmarried males 20-29 per 100 unmarried females 15-24 show even less variation around the national ratio of 66.

Disentangling the associations between nuptiality and the marriage squeeze, increased availability of contraception, and higher rates of female enrollment in secondary schools is impossible. However, the long-term effect of the marriage squeeze on the proportions never married is likely to be small. As previously reported, the proportion of single never-married females in Cuba among older cohorts has declined considerably since 1953, while the proportion of divorced women has increased. Moreover, given the subsequent decline in Cuban fertility since 1965, the current marriage squeeze will only be temporary, to be replaced by a marriage squeeze for men in 1990. The sex ratios for 1985 and 1990, appearing in Table 27, are based on projections of the Cuban population (medium estimate).[15] These projections show a reversal in sex ratios beginning in 1985. By 1985, the ratio of marriage-age men (20-24) to marriage-age women (15-19) reaches unity. By 1990, the ratio of males 20-24 to females 15-19 increases to 112, indicating a shortage of young women for men. The 1990 sex ratio obtained by relating women 15-24 to men 20-29 also reflects this sex imbalance.

The Effect of Emigration on Nuptiality and Fertility

As noted above, over the last 20 years, Cuba has experienced sizable emigration. Between January 1, 1959 and September 30, 1980, 793,856 Cubans are known to have entered the United States permanently; perhaps as many as 100,000 Cubans may have settled in other countries during the same period (Diaz-Briquets and Perez, 1981). Tables 29 and 30 provide data on Cubans admitted permanently to the United States from 1959 to 1980, official Cuban data on net international migration (immigrants minus emigrants), and sex ratios among the emigres. The loss of nearly 800,000 Cubans entering the United States between 1959 and 1980 represents approximately 8 percent of the

TABLE 29 Number of Cubans Arriving in the United States[a], 1959-80

Year	Number of Arrivals	Year	Number of Arrivals
1959	26,527	1970	49,545
1960	60,224	1971	50,001
1961	49,961	1972	23,977
1962	78,611	1973	12,597
1963	42,929	1974	13,670
1964	15,616	1975	8,488
1965	16,447	1976	4,515
1966	46,688	1977	4,548
1967	52,147	1978	4,108
1968	55,945	1979	2,644
1969	52,625	1980	122,061
Total (1/1/59 to 9/30/80)			793,856
Total (4/1/80 to 12/31/80)			125,118

[a]For 1959, January 1 through June 30 only; from 1960 through 1976, year ending June 30; from 1977 through 1980, year ending September 30.

Source: U.S. Department of Justice (1980, 1981).

country's population in 1981. Official Cuban figures shown in Table 30, indicate a net loss of nearly 600,000 persons between 1959 and 1979 (see also Appendix 2). These estimates would be even higher if descendants of emigrants who were born and reside abroad were also included.16

The impact of this large-scale emigration on fertility and nuptiality can be crudely assessed by examining sex ratios within Cuba and among the Cuban-born population in the United States. As noted in Table 4, throughout this century, successive Cuban censuses have recorded extremely high sex ratios, the result of a history of heavy, largely

TABLE 30 Net International Migration, Sex Ratios Among Emigrants, and Correlation Coefficients Between Provincial Nuptiality and Emigration Rates, 1959-79: Cuba

Year	Immigrants Minus Emigrants[a]	Sex Ratios All Emigrants	Sex Ratios Emigrants Aged 15-49	Correlation Coefficients
1959	12,345	--	--	--
1960	-62,379	35.6	5.6	--
1961	-67,468	74.9	58.9	--
1962	-66,264	87.2	78.3	--
1963	-12,201	77.1	64.9	--
1964	-12,791	96.1	93.8	--
1965	-18,003	102.7	102.4	--
1966	-53,409	79.3	66.3	--
1967	-51,972	87.9	81.8	--
1968	-56,755	--	--	--
1969	-49,776	--	--	--
1970	-56,404	85.2	74.3	.35
1971	-49,631	110.8	116.7	.51
1972	-16,856	427.9	518.2	.36
1973	- 7,073	522.1	655.3	.22
1974	- 3,893	480.2	573.6	.36
1975	- 2,891	438.4	527.9	-.05
1976	- 2,891	82.3	83.8	-.23
1977	- 968	67.5	59.2	-.23
1978[b]	- 3,462	108.9	113.6	.19
1979[b]	-16,270	114.4	122.7	.12

Note: -- indicates data unavailable. Correlations computed for years with available data.

[a]Official estimates. The totals may underestimate the extent of net international migration because of unauthorized exits.

[b]Sex ratios in 1978 and 1979 appearing in the third column pertain to the age group 14-64.

Sources: Comite Estatal de Estadisticas (1980:Tables 68 and 69). For provincial nuptiality and emigration rates, see Comite Estatal de Estadisticas (1978, 1979:Table 8).

male-dominated immigration during the first quarter of this century. These high sex ratios can still be detected in the 1970 census (105.2) and less so in the 1981 census (102.4), following the 1980 Mariel sealift. Sex ratios by age for 1970, shown in Table 31, are especially high after age 60, exceeding 105 males per 100 females for the total population. There is some evidence suggesting that the historical tendency toward high sex ratios was reinforced during the 1960s, when females outnumbered males in the emigration stream because the government prevented

TABLE 31 Sex Ratios by Age of Cubans and Cuban-Born Population in the United States, 1970

Age Group	Cuba	Cuban-Born Population in the United States	Reconstructed Sex Ratios
0-4	104.7	102.8	104.7
5-9	104.6	110.4	104.8
10-14	105.2	100.9	105.0
15-19	103.3	98.0	103.1
20-24	102.5	80.2	101.6
25-29	103.8	72.4	102.2
30-34	104.5	85.0	103.0
35-39	101.8	93.0	101.0
40-44	101.7	94.3	101.0
45-49	104.5	96.1	103.7
50-54	107.1	92.1	105.9
55-59	106.2	80.4	104.1
60-64	116.4	78.8	113.3
65-69	125.8	79.7	122.5
70-74	128.9	60.1	122.7
75-79	107.8	55.1[a]	98.3[a]
80-84	101.0		
85+	91.0		
All Ages	105.2	89.0	104.3[b]

[a]Aged 75 and over.
[b]The total reconstructed sex ratio has not been adjusted for emigration, since these effects are minor.

Sources: For Cuba: Comite Estatal de Estadisticas (1980:Table 2). For Cuban-born population in the United States: Bureau of the Census (1973:71).

the emigration of healthy males of military age. During the early 1970s, male emigrants outnumbered females; however, the total number of emigrants was considerably reduced below the levels of the 1960s (Table 30).

Between the 1953 and 1970 censuses, the sex ratio for Cuba increased slightly from 105.0 to 105.2. Data on the Cuban-born population in the United States shown in the third column of Table 31 support this observation: in 1970, there were only 89 men for every 100 women in the U.S. Cuban-born population; among the age group 20-34, the ratios were much lower than would have been antici-

pated (a range of 72 to 85 males per 100 females). A preponderance of males in the large emigration outflow from Cuba to the United States in 1980 will result in a greater similarity between the sex ratios of these age groups among the Cuban and U.S. Cuban-born populations.

It could be hypothesized that in the absence of sex-imbalanced emigration, the fertility rise in the 1960s would have been even more pronounced since the imbalance was concentrated in the peak years of family formation. The data available to test this proposition are extremely limited. However, it is unlikely that this imbalance has significantly affected fertility. As the fourth column of Table 31 shows, there is some change in the reconstructed sex ratios of the Cuban population in 1970 derived from combining by age the 1970 Cuban and U.S. Cuban-born populations. However, this does not suggest that the absence of emigration would have significantly changed the sex ratios of the population of childbearing age.

Though the difference would not have been significant, fertility during the 1960s might have been somewhat lower had the emigres remained, given their characteristically low fertility. In 1970, according to the measures computed from that year's census data, the fertility level of Cuban women in the United States was about three-quarters that of the total U.S population and far below that of other Spanish-origin groups. To illustrate, among the Cuban-born population there were 312.5 children under age 5 per 1,000 women aged 15-44, compared to 404.2 for the total U.S. population.

Greater detail on the fertility of Cuban-Americans is provided in recent analyses from 1970 U.S. census data undertaken by Jaffe et al. (1980). According to these analyses, the number of children ever born to Cuban women aged 15-44 was 1.3 per woman as of 1970. Among women aged 33-44 in 1970 (among whom 78 percent were currently married with spouse present), the average number of children ever born alive per woman (and thus completed fertility) varied from 1.9 children among women with 12 or more years of education to 2.0 children among those with less than 12 years of education. In comparison, the average number of children ever born per woman was much higher among women aged 33-44 years in the non-Spanish white population: 2.7 children among women with 12 or more years of education and 3.1 children among those with less than 12 years of education.

The fertility of Cuban emigrants is likely to remain low. In a survey of later arrivals conducted by Portes et al. (1977) in the early 1970s, the majority of respondents revealed aspirations of upward mobility, scored fairly high on a modernity index, and had the highest labor force participation rate of all Spanish-origin women in the U.S., orientations which tend to reinforce lower fertility.

The Effect of Civilian and Military Overseas Activities on Nuptiality

The sex imbalance at the prime marriage ages described above becomes more marked when allowance is made for the temporary emigration of young Cuban males known to be involved in civilian and military activities in other countries. The potential impact of this involvement has not been examined in depth. It has obviously led to the temporary but at times prolonged separation of otherwise cohabitating couples, and has removed from the country a sizable number of people, mainly males, in the prime marriage ages.

The numbers involved are substantial, and their departure has coincided with the period of rapid fertility decline and rapid expansion of the population aged 15-19, the ages for entry into military service and the labor force. Cuban involvement in Africa began in 1975 with the arrival of Cuban troops in Angola and has continued with similar activities in Ethiopia since 1977. It is believed that by 1978, Cuba had approximately 38,650 military technicians and combat troops in these two nations and other African and Middle Eastern countries (Mesa-Lago, 1981). In addition, thousands of technicians, health personnel, and teachers have served in other countries. It is likely that by 1980, the total number of Cuban civilian and military personnel abroad, mainly young males, may have grown to 50,000 or 60,000 (Diaz-Briquets and Perez, 1981; Latin American Weekly Report, August 1, 1980). Roca (1980a:60) provides the following estimation:

> Cuba had from 47,000 to 49,000 military and civilian personnel on the African continent in 1978 and 1979, or about 1.5 percent of the total labor force in 1978; 44,500 were stationed in Angola and Ethiopia that year (in addition, some 3,000 to

5,000 Cubans were fulfilling internationalist missions in Asia, the Middle East, and Latin America with large numbers of civilian technicians being sent to Nicaragua after July 1979).

By 1981, however, Castro had reported a sizable increase of nearly 15,000 civilian workers in 36 countries, including 1,196 physicians, 2,264 other health workers, 3,562 teachers, and approximately 7,000 construction workers (Castro, 1981:13-14, 20). This level of involvement abroad compares, in relative terms, to that of the United States in Vietnam during the peak years of that conflict. Intensifying the nation's imbalanced sex ratios, this involvement could be expected to have a dampening effect on fertility, principally through the direct mechanisms of family formation: females have fewer potential spouses within the requisite age groups; higher divorce rates and lower probability of remarriage among women might be expected; and, in the case of temporary emigration, postponement of marriage and separation of otherwise cohabiting couples result. As noted previously in Table 27, the sex ratio of males 20-29 per 100 females 15-24 in 1980 (82) is reduced to 78 after adjustment for 40,000 males aged 20-29 serving abroad temporarily. This can at least partly explain the sharp decline in age-specific fertility rates, particularly among women aged 15-19. It can be anticipated that the sex ratio imbalances for some age groups will further intensify during the 1980s since males from urban areas were heavily overrepresented in the 1980 Mariel sealift, during which 125,000 Cubans emigrated.

It should be noted, however, that emigration has also had a less significant pronatalist effect. Given Cuba's housing shortage, emigration appears to be related to nuptiality and fertility. The antinatalist effect of the housing shortage, to be discussed in detail below, results from postponement of marriage or childbearing because of an inability to establish a separate nuclear household or because of overcrowded housing conditions. Figure 12 shows the close correspondence observed between emigration and the marriage rate during the last two decades. The last column of Table 30 illustrates the correlation coefficients found in relating provincial emigration and nuptiality rates.[17] Although these correlations are not high, they are generally in the expected direction: higher during periods of heavy emigration and low, in some cases with a negative sign, during periods of low

emigration. Since the housing shortage is more acute in urban areas and emigrants are predominantly urban in origin, the increased availability of housing will affect nuptiality and household formation predominantly in urban areas.

In conclusion, it does not appear that large-scale emigration during the 1960s had a significant effect on fertility since most emigrants came from social classes with lower fertility. Cuban military and civilian activities abroad, however, would appear to have had some dampening effect on nuptiality and fertility through postponement of marriage and separation of otherwise cohabitating couples. These activities further distort Cuban sex ratios, especially among younger cohorts, who are already experiencing a marriage squeeze due to the effect of the baby boom of the 1960s. Sex ratios and therefore nuptiality and fertility in the coming decade will also be affected by the 1980 Mariel sealift, in which young men were heavily overrepresented.

Decomposition of Change in Birth Rates, 1970-79

As noted above, the period 1970-79 was characterized by rapid fertility decline, the reduction and stabilization of total marriage rates, a slight decline in the proportion of women in union, and a temporary marriage squeeze affecting younger cohorts of women, traceable to the impact of the aging of the baby boom cohort and to Cuban overseas activities.

The extent to which changes in marital fertility and proportions of women in reproductive union contributed to the 1970-79 fertility decline is discussed in this section through application of the standardization technique described in The Methodology of Measuring the Impact of Family Planning Programs on Fertility (United Nations, 1979). The data used in the decomposition were obtained from the 1970 Cuban census, the 1979 National Demographic Survey, estimates of the 1979 age structure, and official estimates of age-specific fertility rates. For both dates, the proportions of currently, legally married women were combined with the proportions of women currently in consensual unions to derive an overall estimate of currently "married" women. The decomposition was calculated for both the general fertility rate and the crude birth rate.

TABLE 32 Decomposition of Change in the General Fertility Rate, 1970-79: Cuba

Component	Absolute Change	Relative Change (percent)
$GFR_{,base\ year\ (1970)}$	121.2	--
$GFR_{,end\ year\ (1979)}$	59.2	--
Observed change (per 1,000)	-62.0	--
Reproductive age structure	- 3.25	-4.65
Marital status distribution	-11.24	-16.07
Marital fertility	-52.10	-74.53
Interaction	4.59	-4.75

According to the estimates for the decomposition of the general fertility rate (Table 32), nearly 75 percent of the overall fertility decline can be attributed to reductions in marital fertility and a less significant proportion to changes in the marital status distribution, that is, a decline in the proportion of women in reproductive unions (16 percent). A further minor contribution was made by changes in reproductive age structure. Decomposing change in the crude birth rate (Table 33) produces a basically similar pattern. Over the period in question, the birth rate declined by 13 points, from 27.6 to 14.6. About 90 percent of this decline resulted from changes in marital fertility and a smaller proportion (20 percent) from a decline in the proportion of women in reproductive unions. Counteracting these tendencies to a small degree was an increase in the number of women in reproductive ages, a consequence of the arrival at these ages of the cohorts born during the early years of the 1960s baby boom.

In summary, the decomposition estimates corroborate that most of the fertility decline during the 1970s was produced by changes in marital fertility. Another important but less significant factor was a reduction in the proportion of women in reproductive unions. This reduction apparently reflects the lower marriage rates during

TABLE 33 Decomposition of Change in the Crude Birth Rate, 1970-79: Cuba

Component	Absolute Change	Relative Change (percent)
CBR, base year (1970)	27.6	--
CBR, end year (1979)	14.6	--
Observed change (per 1,000)	-13.0	--
Number of women of reproductive age	+1.14	+8.8
Reproductive age structure	-.74	-5.7
Marital status distribution	-2.56	-19.8
Marital fertility	-11.86	-91.6
Interaction	-1.02	+8.3

the 1970s, a rise in the proportion of divorced women, and the possible impact of the marriage squeeze.

BREASTFEEDING PATTERNS

Breastfeeding is nearly universal in Cuba, although the median age at weaning is early, between two and three months. The mean duration of breastfeeding and differentials in duration cannot be assessed precisely from the available data--a 1973 survey of 4,272 children representing 99.4 percent of the children surviving at 7 days from a cohort of children born during the first week of March 1973 (single births only). These data, gathered as part of the national investigation of perinatal mortality, pertain to the first 7 months only (Moreno and Rubi, 1979).[18]

As noted in Table 34, among the 4,228 surviving infants, only 4.6 percent had never been breastfed. At age 7 days, 90 percent were fully or partially breastfed, with a supplement of other milk products. A gradual

TABLE 34 Percent of Children Breastfed Partially or Fully, No Longer Breastfed, and Percent Terminating Breastfeeding During the Interval, by Age of Child, Perinatal Mortality Investigation, 1973: Cuba

Duration of Breastfeeding	Percent of Children Still Breastfed at End of Period[a]	Percent of Children No Longer Breastfed at End of Period	Percent Ceasing Breastfeeding During Interval
1 day	95.4	4.6	--
7 days	89.8	10.2	5.6
1 month	72.2	27.8	17.6
2 months	57.0	43.0	15.2
3 months	45.2	54.8	11.8
4 months	39.9	60.1	5.3
5 months	35.7	64.3	4.2
6 months	33.1	66.9	2.6
7 months	32.3	67.7	0.8

[a]Partial breastfeeding includes breast milk supplemented by other milk products.

Source: Moreno and Rubi (1979:Figure 2).

TABLE 35 Primary Reasons for Weaning, Perinatal Mortality Investigation, 1973: Cuba[a]

Maternal Factors		Child-Related Factors	
Insufficient milk	80.6	Milk was not filling	64.6
Poor quality milk	5.8	Child disliked milk	12.4
Pregnancy	1.8	Produced diarrhea	11.1
Work outside home	1.7	Medical indication	5.0
Work inside home	0.2	Insufficient weight gain	3.3
Aesthetic reasons	0.0	Other illness	1.4
Other, unspecified	9.9	Other, unspecified	2.2
Total	100.0	Total	100.0
Number	(2,278)	Number	(1,750)

[a]The total number of reasons (4,028) exceeds the number of children who were no longer breastfeeding at the end of 7 months (2,862) since more than one reason could be offered by the respondent.

Source: Moreno and Rubi (1979:Table 1).

decline in the proportion breastfed, more accentuated in the earlier months of life, followed. The median age at weaning was between 2 and 3 months, with weaning commonly accompanied by supplementation with artificial milk products (infant formula, sweetened condensed milk). At age 7 months, only one-third of the children were still partially or fully breastfed. Although breastfeeding history data on the proportions fully breastfed were not gathered by month, this proportion was only 10 percent at age 7 months. Length of breastfeeding was negatively associated with the incidence of acute diarrheal disease and hospitalization for all illnesses.

As noted in Table 35, the principal reasons for weaning offered by mothers included insufficient milk, inability to satisfy the infant's appetite, or the child's dislike for breastmilk. However, these stated reasons were not reflected in the actual records of weight gain in infants. Other reasons, more appropriately medical (diarrhea, medical indication, insufficient weight gain, other illness), comprised one-fifth of the child-related factors cited for cessation of breastfeeding. Female employment and aesthetic reasons, such as concern with physical appearance, were not major factors associated with weaning. Only 12 percent of the mothers were employed.

Among the nonemployed, one-third were still breastfeeding their infants at age 7 months. Women normally employed outside the home were less likely to breastfeed for this length of time: among those with maternity leave, 19 percent were still breastfeeding at 7 months as compared to 23 percent of those without maternity leave who did not intend to return to the labor force. The shorter duration of breastfeeding among employed women may be due to an underlying association with education. Although no tabulations are presented on the duration of breastfeeding by women's educational attainment, mothers with higher education introduced other foods into the diet at an earlier age, and their infants' diets at age 7 months were more varied.[19] Mother's education was positively associated with lower infant mortality, better food supplementation, higher concurrence with regularly scheduled postpartum infant care appointments, and more frequent use of medical services for illnesses and emergencies, as well as hospitalizations.

The effect of breastfeeding on fertility in Cuba appears to be minor. For purposes of the decomposition of the proximate determinants of fertility described below, the truncated breastfeeding data were simply extrapolated, allowing a 2-percent decline in the proportion of children breastfed for every 1-month period beyond 7 months until about age 2. The mean duration of breastfeeding, calculated in this manner, was 6 months. The final impact of the index of postpartum infecundability on Cuban fertility in the early 1970s was far less significant than that of other intermediate variables (proportions married, contraceptive prevalence, and induced abortion); in comparison to other countries with similar levels of fertility, postpartum infecundability was a less significant factor modifying fertility. Given the importance of breastfeeding for the protection of infant health, however, and the relatively short duration of breastfeeding among Cuban women, the Department of Health Education is developing programs for pharmacists, booklets for distribution at pharmacies, and audiovisual materials directed especially at rural audiences to encourage breastfeeding.

FERTILITY REGULATION

Governmental Policies Related to Fertility Regulation

Cuban Population Policy

Cuba's official population policy was defined at the 1974 Bucharest World Population Conference:

> Cuba is of the opinion that free access to effective contraception and other means of fertility control should be guaranteed to the entire population; however, we maintain that a policy of population and family planning can only be defined as a function of a general plan of economic and social development.

Population growth is currently thought to be compatible with the nation's economic development strategies. The government has maintained that an integrated process of socioeconomic development, involving sustained economic growth, income redistribution, and full employment, obviates the need for a policy aimed specifically at reducing population growth (United Nations and UNFPA, 1979).

Although Cuba has no specific targets for fertility reduction, the government has established a variety of objectives related to fertility regulation. Briefly summarized, these include the following: reduction of the frequency of abortion and repeat abortion; prevention of high-risk pregnancies; improved quality of maternal/child health/family planning services through the use of more effective contraceptives and increased coverage to reduce regional availability differences; and prevention of the transmission of genetically determined illness (UNFPA, 1982b). In addition, government goals have been established for infant and maternal mortality, as noted in Table 36, which reports official mortality figures based on death registration data, rather than mortality estimates based on census and survey data. As previously discussed, the analysis of census and survey data largely confirms the general level of the infant mortality rates based on registered deaths for the 1960s and early 1970s, but indicates higher infant mortality for the mid-1970s and late 1970s. Nevertheless, according to the official figures, targets for infant and child mortality reduction have largely been met, and substantial progress has been

TABLE 36 Infant and Maternal Mortality Rates and Long-Term Objectives for Maternal and Child Mortality, 1970-82: Cuba

Mortality Measure[a]	1970	1975	1978	Long-Term Objectives 1978	1982
Perinatal mortality	33.0	26.5	22.9	24.0	24.0
Late fetal mortality	15.3	11.7	10.7	12.0	12.0
Early neonatal mortality	17.7	14.8	12.2	12.0	10.0
Neonatal mortality	23.8	17.4	14.5	14.0	12.0
Postneonatal mortality	15.0	10.1	7.8	6.0	8.0
Infant mortality	38.8	27.5	22.3	20.0	20.0
Maternal mortality[b]	70.5	68.4	45.2	20.9	40.0

[a]Rates per 1,000 live births except where indicated.
[b]Rates per 100,000 live births.

Sources: 1970 figures: Ministerio de Salud Publica de Cuba (1979). 1975-82 figures: INFPA (1982a).

made in efforts to reduce maternal mortality through the expansion of health services. In turn, these efforts have indirectly reduced fertility through efforts to prevent high-risk pregnancy among older, multiparous women.

Policies Designed to Provide Access to Abortion and Contraception

The rapid decline in Cuban fertility has been promoted by government policies designed to provide equal access to legal abortion and contraception. No freestanding family planning programs exist; rather, fertility regulation has been integrated into the Cuban system of socialized medicine as part of the maternal and child care program, which has received the highest priority in the national health program. The spread of services within rural areas and educational efforts on fertility regulation through polyclinics and mass organizations have been major factors accounting for fertility decline in Cuba and reduction in interprovincial fertility differentials since the mid-1960s. Cuban women have free access to legal abortion performed by physicians in hospitals to

reduce both the negative effects of high fertility on maternal health and reliance on unsafe illegal abortion. Since the mid-1970s, the government has also increased the availability of contraceptive services in polyclinics, hospitals, and national pharmacies to reduce the incidence of repeat abortion and to improve maternal and child health through spacing. Results of the decomposition of the proximate determinants of fertility for the early 1970s indicate that contraception is Cuba's major method of fertility regulation, with abortion as a secondary factor.

Abortion Laws pertaining to abortion in Cuba date back to the Spanish Penal Code of 1870, later incorporated into the Cuban Penal Code of 1879 and the Social Defense Code of April 1936. According to the latter, abortion was highly restricted legally and prohibited except on grounds of grave danger to the woman's life or health, on juridical grounds (pregnancy following rape or abduction without marriage), or on eugenic grounds (anticipated physical or mental impairment). The conditions constituting high risk to a woman's health were not defined by the law, however, and merely required the concurrence of two physicians. Thus, abortion was available in large urban areas, especially in Havana, where physicians charged moderate fees according to the social class of their patients.

From 1959-64, however, the antiabortion law was more strictly observed. The emigration of private physicians in the early revolutionary period (officially reported but perhaps overestimated as 2,000-3,000 of the previously existing 6,300 physicians) increased the difficulty and cost of obtaining an abortion; this resulted in greater reliance on unskilled practitioners and a rise in maternal mortality. During this period, moreover, Cuba's contraceptive practice lagged behind that of some other Latin American countries, and a shortage of contraceptive supplies also developed following the economic blockade. As a result, the incidence of illegal abortion increased; between 1962 and 1965, clandestine abortion accounted for nearly one-third of all maternal deaths (other causes included traumatic births and infections). Therefore, in late 1964, the Social Defense Code was amended to make the conditions for abortion more flexible: the World Health Organization definition of health was adopted--"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO,

1970). These criteria, which became the medical norms for termination of pregnancy established by the Ministry of Public Health, have resulted in greater access to abortion since 1965 through the national public health system.

Most abortions are performed in provincial maternity hospitals and general medical-surgical hospitals by vacuum aspiration or surgical curettage. Abortions up to 12 weeks of gestation are performed solely at the woman's request for single women 18 years of age and older and married women, and consent of the partner is not required. Single women under the age of 18 require parental permission for an abortion according to the norms of the Ministry of Public Health. However, in reality such approval is not always necessary. Abortions after 12 weeks are also performed, but require validation by the director of the institution and approval by the obstetrician-gynecologist, which is usually forthcoming. National data on the incidence of second-trimester abortion are unavailable. A recent study conducted in a Havana gynecology and obstetrics hospital reported that repeat abortions constituted 1.5 to 12 percent of all induced abortions (Valdes Vivo et al., 1978). Small-scale studies of women requesting hospital abortions have estimated a higher incidence of repeat abortion, ranging from 28 to 58 percent among the women sampled currently requesting abortion (Gonzalez Perez, n.d.).

Under the new penal code of November 1, 1979, which covers all laws, not only those relating to abortion and health, punishment has been established for illegal abortions (loss of physician's license and imprisonment). Illegal abortions are defined as those performed without the permission of the woman, for profit, outside hospitals, or against the regulations established by the Ministry of Public Health. This new penal code reflects a change in law but not in practice since the age and gestation guidelines pertaining to the provision of abortion remain unchanged. Additional norms regarding appropriate abortion techniques and length of hospital stay will also be established in the near future.

Abortion is not perceived as the most desirable form of fertility regulation. Since abortion is not without risk, it is viewed as an emergency solution for unwanted pregnancy, which can be avoided through preventive contraception. Since abortions cannot be eliminated by law, the government has elected to make them safe, and, since

the mid-1970s, to try to replace abortion with contraception.

Contraception Contraception was not emphasized by the Cuban government until the mid-1970s because of the priority assigned to other needs within the health system and a shortage of contraceptive supplies. Although modern contraceptive methods were available in Cuba during the early 1960s, their quantities were limited. Contraception was provided in public health facilities on request or upon recommendation by physicians following abortion. Intrauterine devices (IUDs), manufactured within Cuba or purchased from countries in Eastern Europe, were most frequently used; in 1971, it was reported that eight polyclinics and five hospitals in Havana averaged a total of 4,700 IUD insertions per month (Chelala, 1971). Sterilization was used primarily by older women 35 and over.

The provision of contraceptive service was given impetus in 1974, when the Cuban government signed an agreement with the United Nations Fund for Population Activities (UNFPA) during the World Population Conference in Bucharest. This agreement included the provision of some $384,000 for contraceptive materials, primarily for local manufacture of oral contraceptives and distribution of IUDs in a total 1975-78 budget of $3,861,000. Although large in absolute terms compared to other UNFPA projects, this assistance was equivalent to approximately 2.8 percent of the total planned government contribution for that period ($138,088,771), although no data are available on actual government expenditures (UNFPA, 1982a). Most of the aid, first received in 1976, was used to improve maternal and child health services by furnishing polyclinics and pediatric and maternity hospitals with equipment for obstetrical/gynecological procedures and pregnancy termination, as well as contraceptive supplies. Prenatal care, supervised deliveries, reduction in perinatal risk, and improvement in neonatal care were emphasized. Training fellowships for personnel involved in the maternal and child health program were also provided (United Nations, 1977; UNFPA, 1975).

Cuba received further assistance under a joint agreement with UNFPA calling for $6 million between 1979 and 1982, equivalent to approximately 6.5 percent of the total planned government contribution of $92,600,000. UNFPA assistance was to be used to expand the maternal and child health program; improve the collection, analysis, and dissemination of vital statistics and

demographic data, including the 1981 Census of Population and Housing; and provide demographic training. During the period 1975-81, UNFPA expenditures for Cuban projects totaled $6,430,601.[20]

The International Planned Parenthood Federation (IPPF) has provided financial assistance to Cuba since 1971 through the Cuban Scientific Society for Family Welfare (SOCUDEF), which was granted associate membership in IPPF in 1980. Financial support and commodities (contraceptives, medical equipment, and materials for contraceptive and sex education) provided to Cuba by IPPF totaled $221,400 in 1978, $248,201 in 1979, and $245,000 in 1980 (IPPF, 1982).

There is no minimum age for purchase of contraceptives in Cuba, nor is the permission of spouse or parents required. In fact, no norms have been established regarding the provision or delivery of contraceptive methods, although physicians seem well-informed about contraindications and side-effects associated with various methods. The main contraceptive methods available are IUDs, female sterilization, and oral contraceptives; pills, condoms, and spermicides (tablets, jellies, and creams) are sold in national pharmacies at low cost, and all other methods are free. While all methods are available, no contraceptive prevalence data have been collected at the national level. The IUD and female sterilization are most popular, according to the results of a recent fertility survey conducted in an urban municipality of Havana.

Although pamphlets on contraceptive methods include discussion of rhythm, withdrawal, douche, and spermicides, these are described as relatively ineffective in preventing pregnancy, as is breastfeeding; use of contraception prior to the resumption of postpartum sexual relations is advocated (Rodriquez Castro, 1981). Condoms are recommended for adolescent males and in situations of irregular coitus; however, although supplies of condoms are made available in pharmacies, they are reportedly unpopular. IUD insertions are performed free in polyclinics and hospitals, both postpartum and postabortion. Gynecologists prefer the IUD for birth spacing since this method is regarded as effective with an acceptable level of risk. Diaphragms are also available in health units. Low-dose oral contraceptives have been used in Cuba since the mid-1970s, provided by international donations and manufactured in Cuba from imported materials. Sold in pharmacies with or without prescription, a 1-month cycle of 20 or 21 tablets costs one peso (currently U.S.

$1.32). Women are urged to consult a physician at the beginning of use and periodically thereafter, although there is no explicit follow-up of pill acceptors, except in a few health clinics that follow contraceptive users with high-risk characteristics.

Sterilization is also available. However, one reported barrier to greater reliance on this method is the shortage of specialists trained in new sterilization techniques. Social workers also discourage reliance on sterilization, advocating reversible forms of contraception instead. Female contraceptive sterilization is usually performed in hospitals; mini-laparotomy and laparotomy are the main techniques, although laparoscopic sterilization has recently been introduced in Havana. Current age and parity restrictions limit sterilization to women who are at least 28 years of age with three children. Husbands must be informed of the procedure, although their consent is not required. Therapeutic sterilizations may also be obtained, with the approval of hospital directors, for various medical indications (maternal or child health, previous history of high-risk pregnancy or cesarean section). Vasectomies are also performed by urologists in Havana. However, as in other Latin American countries, this method is unpopular, and its prevalence is described as "minimal" (Rodriguez Castro, 1980), probably because of the availability of female sterilization and attitudes of machismo.

The Role of Mass Organizations Through integration with mass organizations, health care, including education on family planning, is designed to ensure contact with the large majority of adult citizens, many of whom have multiple memberships. Particularly active in this regard are the Committees for the Defense of the Revolution (CDR), which exist on nearly every block in urban areas and in defined districts in rural areas. Originally organized in 1960 to guard against sabotage and to assist in the organization of the militia, they have since broadened their activities to include mobilization for volunteer work in public health. The CDR is responsible for registration of the population at the appropriate polyclinic; records of immunization schedules (polio, tetanus, diphtheria, and pertussis) for those at high risk in the local neighborhood; control of mosquitoes; environmental upgrading; and street cleaning (Danielson, 1979). Health and hygiene representatives in each CDR are also responsible for matters such as promoting the

use of prenatal services and postpartum medical care for infants, motivating women to obtain Pap smears, and following up on polyclinic patients who have missed appointments.

The Federation of Cuban Women (FMC) mobilizes neighborhood women for volunteer work, runs national day care centers and literacy and educational classes for women, and assists in the acquisition of employment and child care; it also works in the areas of pediatric and maternal health, sex education, and family nutrition. At meetings of the CDR and FMC, polyclinic staff provide presentations and discussions concerning pregnancy, sexuality, breastfeeding, nutrition, pre- and postpartum care, family planning, and parental responsibilities as outlined in the Family Code. Some information on health is periodically provided by the press and by radio and national television. In coordination with the Ministry of Public Health, a bi-weekly television program is broadcast ("Ciencia y Salud" ["Science and Health"]); press coverage is provided through magazines produced by the FMC for women and teenagers. However, the major source of information is the classes in family planning, preparation for childbirth, and infant care conducted in polyclinics and maternity homes prior to birth. Advice on contraceptive use is provided by personnel in several specialties, including obstetrical nurses, psychologists, social workers, and obstetrician-gynecologists. Special education efforts, explaining the risk of additional pregnancies, are directed at older, high-parity women and those with special health problems.

Sex Education In 1975, the first Congress of Cuba's Communist Party approved a resolution calling for adequate sex education. When the Cuban National Assembly of Popular Power was elected in 1975, it established a Permanent Commission for matters relating to children and the equality of women. The Commission began formulating a program for sex education in 1977, coordinated since 1979 by the National Working Group on Sex Education, which is composed of members of various mass organizations (the Cuban Federation of Women, the Union of Young Communists, plus representatives of the Ministries of Public Health and Education). The program emphasizes biological and social aspects of sexuality, responsible parenthood, and instruction in contraception and abortion. Although financial resources devoted to activities are limited, work to date has emphasized publications and

mass media programs on sex education, the development of sex education programs for specific population groups, and training of personnel in sex education. Coordination between the National Working Group, mass organizations, and the Ministries at the national and provincial levels provides a network through which sex education activities can be conducted on a national basis.

Although supplies are currently exhausted, three books have so far been produced, based on books already published in the German Democratic Republic: one for the general population; one for adolescents; and one for professionals. Two pamphlets on prenatal development have been published for incorporation in the school curriculum, for children 9 to 12 and their parents; materials for children below age 9 and their parents are in preparation.

No data are available by which to judge the effect of previous sex education activities on knowledge, attitudes, and practices of adolescents with regard to parenthood, contraception, or abortion. As noted above, although the fertility of women aged 15-19 declined in the late 1970s, the relative role in this decline of availability of contraception, sex education, and various demographic factors cannot be discerned.

Contraceptive Prevalence

No national data on contraceptive use have been collated by Cuba's Ministry of Public Health. Provincial- and national-level data are available on sales of oral contraceptives and condoms and on the distribution of IUDs and oral contraceptives to health units; however, these data are rarely converted into estimates of the number of women protected. Although each polyclinic records information on the number of sterilizations performed, on IUD acceptors and removals, and on the use of other methods, these statistics are not centralized nationally. Thus, data on new acceptors, continuation rates, reported side-effects, and patterns of method switching, as well as contraceptive prevalence by type of method, age group, province, and rural-urban residence, are unavailable (UNFPA, 1982b).

Data on contraceptive knowledge and use in Cuba during the last decade are limited to information from five fertility surveys conducted between 1971 and 1973 and a study conducted in 1980 (Alvarez Vazquez, 1972, 1973,

1975; Alvarez Vazquez and Alvarez Lajonchere, 1978; Alvarez Vazquez and Ruben Quesada, 1973; Gonzalez de la Cruz, 1980; Vila and Alvarez, 1980). The surveys undertaken in the early 1970s include one conducted in a region within the metropolitan area of Havana (Plaza de la Revolucion); two conducted on the periphery of Havana (Marianao and Bauta); one in the city of Santa Clara, capital of the central province of Las Villas; and one in the rural mountainous region of Yateras in the province of Oriente.[21] The 1980 survey was conducted in Arroyo Naranjo, an area with semi-rural characteristics at the edge of the city of Havana.

Although not shown in tabular form, the survey data indicate that more than 90 percent of the women interviewed in the early 1970s knew of at least one method among the seven listed. The IUD was best known, followed by female sterilization and the condom; the least-known method was the pill. Data on contraceptive knowledge collected in the more recent survey in Arroyo Naranjo demonstrate widespread knowledge of all methods distributed through the health system: more than 90 percent of the women knew of the condom, sterilization, pill, and IUD; somewhat lower levels of knowledge (75-78 percent) were recorded for the diaphragm, douche, rhythm, and withdrawal.

Although Table 37 and Figure 15 provide data on levels of past use and contraceptive prevalence levels, they typically pertain to samples of women aged 15-49, rather than to women in union. During the early 1970s, the highest levels of past use were recorded for the IUD and the condom; sterilization was the most frequently used method among women above age 35. In the early 1970s, approximately 35 to 64 percent of the women of reproductive age surveyed reported that they were currently using a method of contraception, with the lowest proportion recorded in rural Yateras and the highest in Ciudad Bauta. These figures are somewhat inflated since they include women who were using more than one method at a time, allowing for the possibility of double counting. Considerably smaller proportions of women (25-34 percent) in the urban areas and 22 percent in rural Yateras were currently using an effective contraceptive method (IUD, sterilization, diaphragm, or pill). Use of the IUD ranged from 16 percent to 22 percent. Sterilization ranged from 5 percent to 13 percent; despite widespread knowledge of this method, access is restricted by various age and parity regulations. Use of the pill, supposi-

TABLE 37 Percent of Women Aged 15-49 Reporting Ever Use and Current Use of Contraception for Selected Sites, 1972-80: Cuba

Method	Yateras 1972		Plaza de la Revolucion 1971		Ciudad Santa Clara 1972		Ciudad Bauta 1973		Municipio Marianao 1973		Arroyo Naranjo[a] 1980	
	Ever Use	Current Use[b]	Ever Use	Current Use[b]	Ever Use	Current Use[b]	Ever Use	Current Use[b]	Ever Use	Current Use[b]	Ever Use	Current Use
Total	--	34.6	--	54.7	--	56.8	--	63.9	--	53.6	--	68.4
Intrauterine device	28.6	16.5	28.5	17.3	23.0	15.9	33.0	21.4	37.1	22.2	62.4	37.0
Female sterilization	5.1	5.1	7.3	7.3	12.5	12.5	8.4	8.4	9.3	9.3	15.8	15.8
Condom	12.5	3.5	31.6	7.0	39.1	11.4	41.3	11.3	30.5	6.2	29.3	3.5
Withdrawal	13.4	6.4	25.0	7.4	28.3	9.5	25.4	7.7	20.6	4.2	16.7	2.1
Rhythm	6.1	3.1	25.7	8.0	20.3	7.5	15.9	6.6	19.0	4.2	18.5	1.6
Other[c]	9.4	--	46.7	7.7	32.3	--	39.4	6.9	37.6	5.3	21.7	1.6
Diaphragm	--	--	9.5	--	--	--	7.1	1.6	7.6	1.8	10.7	--
Pill	--	--	2.8	--	--	--	0.1	--	0.9	0.4	22.6	6.8

Note: -- indicates data unavailable.

[a]Percentages are based on women living in union. All other urban samples are probability samples of women in their reproductive years 15-49 with the exception of the Yateras study, which was a census of all women of reproductive age.
[b]Figures on current use include users of multiple methods and are therefore somewhat inflated.
[c]Other includes douche, contraceptive jelly, cream, and vaginal suppositories.

Sources: Santa Clara data: Alvarez Vazquez (1973). Yateras data: Alvarez Vazquez (1972). Bauta and Marianao data: Gonzalez de la Cruz (1980). Plaza de la Revolucion data: Alvarez Vazquez and Ruben Quesada (1973). Arroyo Naranjo data: Vila and Alvarez (1980).

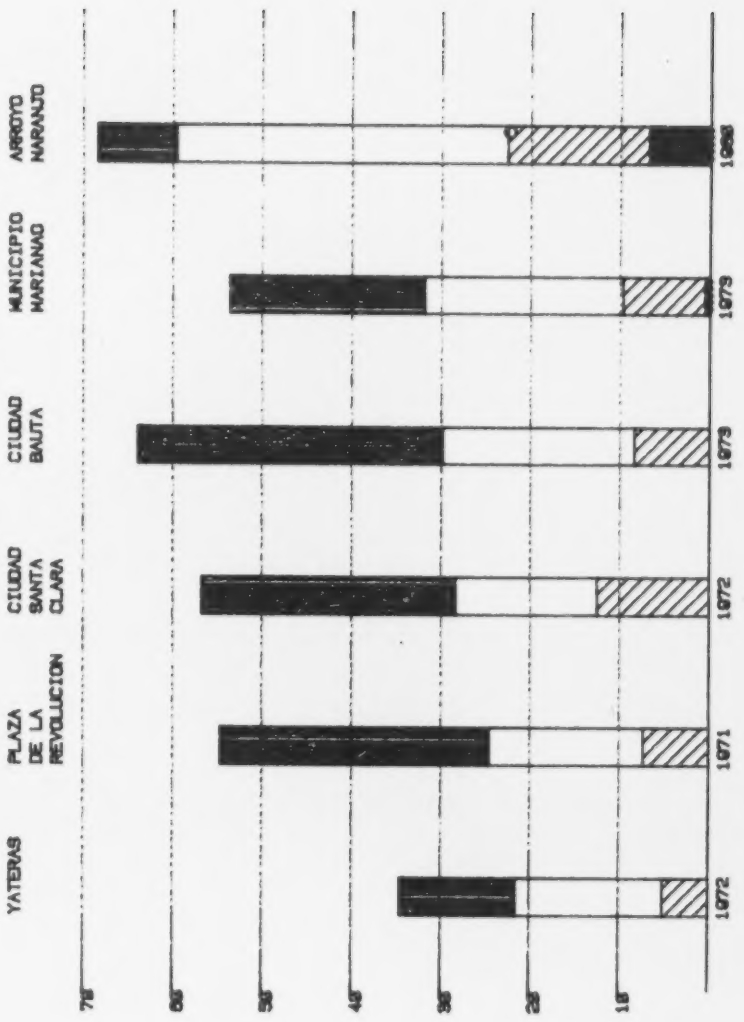

FIGURE 15 Contraceptive Prevalence Rates Among Women Aged 15-49, by Method, Selected Sites, 1972-80: Cuba

tories, jellies, and diaphragm was extremely limited; around 8 percent of the women in Bauta and Marianao reported currently using one of these methods in 1973.

Data on the proportion of women currently in union who were using contraception are scant. In Marianao, 47.9 percent of the women of reproductive age were currently using a method (excluding multiple-method uses); among those currently in union, the proportion was 71.1 percent. In Bauta, 55.6 percent of women of reproductive age were current users; among those currently in union, the proportion was 74.5 percent. The proportion of women of reproductive age living in union appears to be 70 to 75 percent for the urban areas and 80 percent for rural Yateras. Thus, it can be estimated that the proportion of women currently in union who were using effective contraceptive methods at the time of the interview was 33 to 49 percent (25/75-34/70) in urban areas and 28 percent (22/80) in the rural sample.

The 1980 survey conducted in Arroyo Naranjo, also shown in Table 37, is not directly comparable to the earlier studies since it sampled women aged 15-49 living in union rather than all women of reproductive age. This more recent survey showed a higher figure than the earlier surveys for use of contraception among urban women in union: 68 percent were current users, while 60 percent were using the three most effective methods--IUD (37 percent), sterilization (16 percent), and pill (7 percent); in comparison, an estimated 33 to 49 percent of urban women in union were using effective contraceptive methods in the early 1970s. However, given differences in the marital composition of the samples, time trends in method use cannot be accurately assessed. Moreover, no data on contraceptive prevalence by age group have been published recently to indicate shifts in method use.[22] The pill is thought to be the most frequently used method among adolescents, accounting in part for the decline since 1977 of fertility among those aged 15-19. However, no data are available to corroborate this assumption.

As noted above, no national data on contraceptive prevalence, number of acceptors, or continuation rates are available for Cuba. However, empirical data show a close relationship between the contraceptive prevalence rate and the crude birth rate. The straight line of best fit to 37 points (32 countries, five with points at two periods), relating the prevalence rate and the crude birth rate a year later for the late 1970s, suggests that every 2.4 percentage point increase in contraceptive

prevalence is associated with a one point decline in the birth rate. According to the regression relation (Y = 46.9 - .42X), the crude birth rate would be 47 if no couples practiced contraception and 5 if all did (Nortman and Hofstatter, 1980). On the basis of this equation, it can be estimated that some 53 percent of all married women of reproductive age were using contraception in 1972 (1973 crude birth rate of 25), in comparison to 79 percent in 1980 (1981 crude birth rate of 14). These figures are high given the level of induced abortion in Cuba; other factors influencing the relationship are marriage patterns, prevalence and duration of lactation, and age structure.

On the basis of these limited data, it appears that Cuba's relatively low prerevolutionary birth rate was achieved through use of less effective contraceptive methods and abortion. In the immediate postrevolutionary period, a decline in the prevalence and practice of both is partially responsible for the upturn in the birth rate, followed by a reversion to the previous pattern by the early 1970s. By 1980, the increased availability of government-supplied contraceptives (primarily the pill, the IUD, and sterilization) had resulted in reduced reliance on less effective methods, higher contraceptive prevalence, and greater access to contraceptive services.

The effect of this greater availability of modern contraceptives since the mid-1970s on reducing reliance on legalized abortion is examined in the next section, as is the impact of government policies liberalizing abortion and the resulting reduction in fertility and abortion-related mortality.

Access to Abortion and Declines in Fertility and Abortion-Related Mortality

Table 38 presents data on abortion incidence in Cuba during 1968-80, a period, as noted above, of increased access to legal abortion and sharply declining fertility.[23] Total abortions have been divided into legal and "other" (a category including spontaneous abortions, some therapeutic curettage related to uterine and gynecological diseases, and incomplete illegal abortions requiring medical treatment).[24] Two measures of abortion incidence are presented: the abortion rate, which measures the incidence of legal and total abortions per 1,000 women aged 15-44; and the abortion ratio, which

TABLE 38 Number of Women Aged 15-44, Number of Live Births and Abortions, Abortion Rates and Ratios, and General Fertility Rate, 1968-81: Cuba

Year	Women 15-44 (in 1,000s)	Live Births	Legal Abortions	Other Abortions	Total Abortions[a]	Legal Abortion Rate[b]	Total Abortion Rate[b]	Legal Abortion Ratio[c]	General Fertility Rate
1968	1,708	251,857	28,485	43,424	71,909	16.7	42.1	103	147.5
1969	1,731	246,005	46,080	47,420	93,500	26.6	54.0	160	142.1
1970	1,754	237,019	70,521	42,485	113,006	40.2	64.4	222	135.1
1971	1,788	256,014	84,823	36,224	121,047	47.4	67.7	252	143.2
1972	1,822	247,997	100,045	34,056	134,101	54.9	73.6	297	136.1
1973	1,858	226,005	112,107	32,069	144,176	60.3	77.6	343	121.6
1974	1,893	203,066	131,536	33,718	165,254	69.5	87.3	399	107.3
1975	1,930	192,941	126,107	33,510	159,617	65.3	82.7	399	100.0
1976	1,991	187,555	121,415	31,039	152,454	61.0	76.6	405	94.2
1977	2,053	168,960	114,829	30,647	145,476	55.9	70.9	420	82.3
1978	2,118	148,249	110,431	27,420	137,851	52.1	65.1	431	70.0
1979	2,185	143,551	106,549	25,546	132,095	48.8	60.5	432	65.7
1980	2,205	136,900	103,974	24,896	128,870	47.2	58.4	--	62.1
1981[d]	2,271	136,211	--	--	--	--	--	--	60.0

Note: -- indicates data unavailable.

[a]Total abortions equal legal abortions plus other abortions.
[b]Procedures per 1,000 women, 15-44.
[c]Legal abortions per 1,000 total pregnancies (abortions plus live births) in the year beginning six months after the year in which abortions were measured.
[d]Provisional data.

Sources: Ministerio de Salud Publica de Cuba (1979, 1981); JUCEPLAN, C.E.E. (1981); Rodriguez Castro (1978); United Nations (1976); UNFPA (1982b).

expresses the proportion of all pregnancies ending in legal abortion, defined as the number of legal abortions per 1,000 pregnancies (abortions plus those live births taking place during a 12-month period commencing 6 months later than the period during which abortions were measured, to give a reasonable approximation of the conception cohort). Mortality rates have also been calculated, based on the number of births in a calendar year. To examine the effect of declining fertility and increased abortion availability on mortality, various rates have been calculated for maternal mortality, total abortion mortality, legal abortion mortality and nonabortion mortality, which excludes deaths related to legal and other abortions.

Between 1968 and 1971, the general fertility rate (the number of births per 1,000 women of reproductive age) fluctuated between 148 (in 1968) and 143 (in 1971) (Table 38 and Figure 16). Since then it has fallen consistently to a provisional rate of 60 in 1981. Increasing access to legal abortion sharply reduced the incidence of illegal abortions during this period: in 1968, other abortions represented substantially more than one-half of the total abortions reported; by 1980, this proportion had been reduced through greater availability and better education to only about one-fifth of all abortions, indicating that the "other" category now includes primarily spontaneous abortions (Hollerbach, 1980a).

Increased availability of legal abortion has reduced the number of deaths and death rates associated with abortion, as noted in Table 39 and Figure 16. In 1968, 62 abortion deaths were recorded, of which 61 were due to other abortions, including illegal procedures. The total abortion death rate was 3.6 per 100,000 women aged 15-44; the legal abortion death rate was 0.06 per 100,000. In 1974, only 30 abortion-related deaths were recorded, of which 29 were associated with other abortions. The legal abortion death rate was nearly the same in 1968--0.05 per 100,000 women aged 15-44--but the total abortion death rate had fallen to 1.6 as a result of the declining incidence of the more dangerous illegal abortions. This compares favorably with abortion mortality figures for the United States, Hungary, and Czechoslovakia (Tietze, 1983).

Increased availability of legal abortion has also reduced the incidence of total abortion mortality, which increased from 13.7 deaths per 100,000 live births in 1960 to a high of 25 deaths in 1969, and subsequently

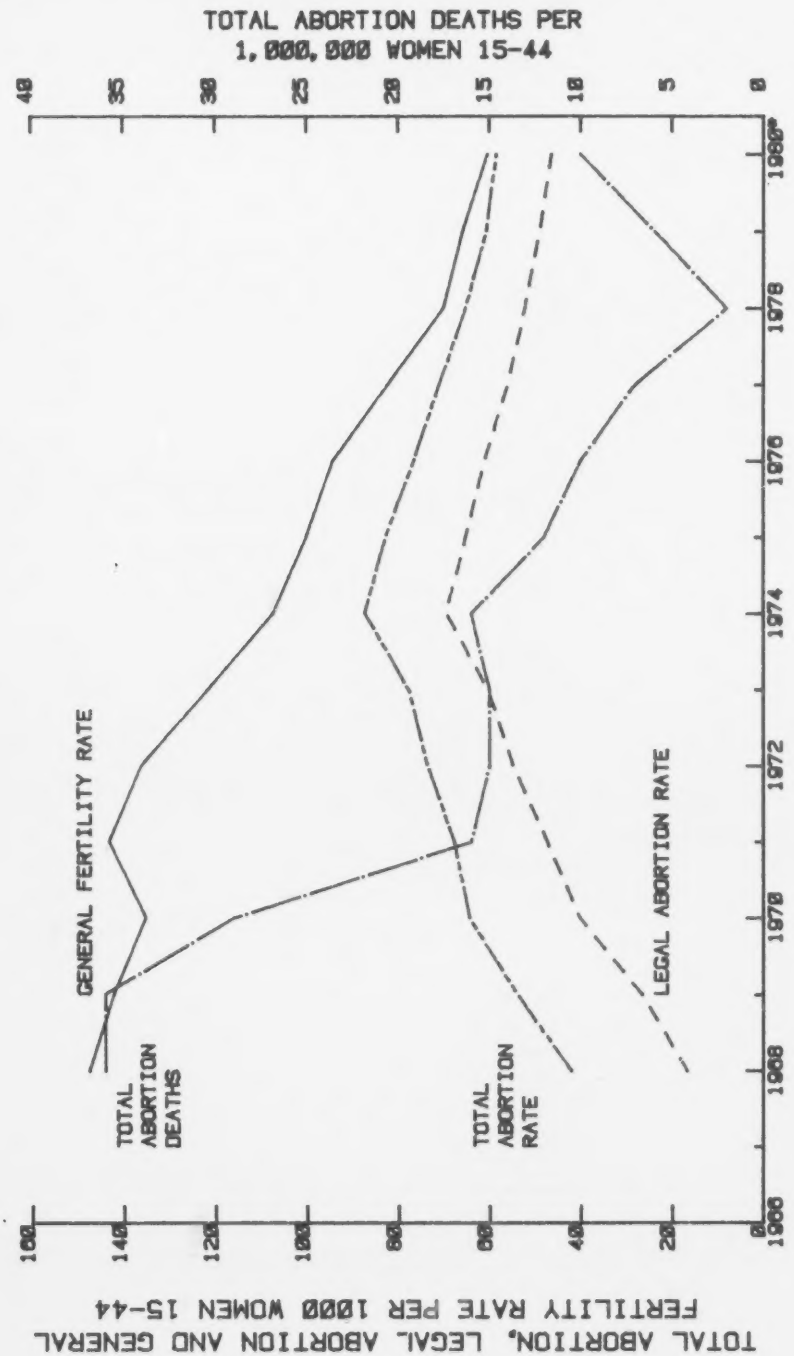

FIGURE 16 Total Abortions, Legal Abortions, and General Fertility per 1,000 Women Aged 15-44, and Total Abortion Deaths per 1,000,000 Women Aged 15-44, 1968-80: Cuba

TABLE 39 Measures of Abortion-Related and Nonabortion-Related Maternal Mortality, 1968-81: Cuba

Year	Maternal Mortality Rate[a]	Total Abortion Mortality Rate[a]	Non-Abortion Mortality Rate[a]	Legal Abortion Mortality Rate[b]	Total Abortion Deaths	Legal Abortion Deaths	Total Abortion Deaths per 100,000 Women, 15-44	Legal Abortion Deaths per 100,000 Women, 15-44
1968	83.0	24.6	58.4	--	62	1	3.6	0.06
1969	85.0	25.2	59.8	--	62	--	3.6	--
1970	70.5	21.5	49.0	--	51	--	2.9	--
1971	67.6	11.3	56.3	1.2	29	1	1.6	0.06
1972	52.0	10.9	41.1		27	0	1.5	0.00
1973	55.3	12.4	42.9		28	3	1.5	0.16
1974	58.1	14.8	43.3		30	1	1.6	0.05
1975	68.4	11.9	56.5	1.1	23	2	1.2	0.10
1976	47.5	10.7	36.8		20	0	1.0	0.00
1977	49.1	8.9	40.2		15	3	0.7	0.15
1978	45.2	3.4	41.8		5	0	0.2	0.00
1979	51.5	9.8	55.9	--	14	--	0.6	--
1980	52.6	15.3	46.8	7.7	21	8	1.0	0.36
1981[c]	40.4	--	--	--	--	--	--	--

Note: -- indicates data unavailable.

[a]Per 100,000 live births. This rate takes into account all maternal deaths associated with abortions (legal and all other abortions).
[b]Per 100,000 legal abortions.
[c]Provisional data.

Sources: Ministerio de Salud Publica de Cuba (1979, 1980, 1981); JUCEPLAN, C.E.E. (1981); Rodriguez Castro (1978); United Nations (1976); UNFPA (1982a). Statistics on mortality on file at the World Health Organization data bank in June 1980, supplied by Dr. H. Hansluwka.

declined steadily to 3.4 deaths per 100,000 live births in 1978. Since 1978, this figure has increased to 15.3 deaths per 100,000 live births. This recent rise is in part attributable to a sudden increase in deaths associated with legal abortion: among the 72 maternal deaths from all causes recorded in 1980, 21 were associated with total abortion and 8 with legal abortion; the legal abortion mortality rate increased to 7.7 in 1980. Recent international data suggest an average of 1 death per 100,000 abortion procedures within a hospital setting. Thus, the recent Cuban figure is about eight times higher than might be expected (UNFPA, 1982b).[25] Cuba's non-abortion mortality rate of 47 deaths per 100,000 live births is still considerably below the earlier figures recorded for 1968-69 (58-60 deaths), in part because of the integrated maternal-child health program.

With the reduction in the incidence of illegal procedures, the incidence of legal abortion rose. As noted in Table 38 and Figure 16, the legal abortion rate per 1,000 women aged 15-44 rose from 17 in 1968 to 70 in 1974. Expressed as a total abortion rate (the average number of abortions per woman during her lifetime at prevailing incidence levels), the rate increased from .5 abortions per woman in 1968 to 2.1 abortions in 1974. After that point, largely because of the greater availability of effective contraceptives, the rate declined to an estimated 47 in 1980, or 1.4 abortions per woman.

The abortion ratio showed substantial and consistent annual increases throughout the period, however, as noted in Table 38. From 103 in 1968, the ratio rose to 432 per 1,000 pregnancies in 1979, indicating that fertility declines have been accomplished by a heavy reliance on induced abortion as a back-up method in case of contraceptive nonuse or failure (Hollerbach, 1980a). Recent abortion data show that only four countries had higher abortion ratios than Cuba's during the 1970s: Bulgaria (95 in 1979); Japan (47 in 1975); Romania (498 in 1979); and the U.S.S.R. (700 in 1970) (Tietze, 1983). The abortion ratio for Havana is higher than the overall rate for Cuba, and the reported incidence is generally higher in urban than in rural areas of the country.[26]

It is probable that in the early period following abortion liberalization, abortion was used primarily by higher-parity women to prevent unwanted births. As noted above, educational efforts were originally directed at high-parity women, and in 1968 only 10 percent of all known pregnancies (excluding spontaneous and illegal

induced abortions) were terminated through legal abortion. In the early 1970s, the rise in the legal abortion rate was probably associated with the increased availability of abortion services and the relaxed use or method failure associated with traditional contraceptive methods. By 1979, the incidence of abortion and the legal abortion rate had again declined with the greater availability and use of effective contraceptive methods. However, the abortion ratio continued to rise as fertility dropped precipitously during the decade. By 1979, 40 percent of all known pregnancies were terminated by abortion. This increase may be attributable to low fertility desires, as expressed in the 1979 National Demographic Survey, as well as to reliance on abortion in preference to contraception or in situations of contraceptive failure.

DECOMPOSITION OF THE PROXIMATE DETERMINANTS OF FERTILITY

The fertility effects of the four most significant proximate determinants of fertility--proportions in union, contraceptive prevalence and effectiveness, incidence of induced abortion, and duration of postpartum infecundability--as measured through the Bongaarts (1982) model, can be assessed only for the early 1970s. Although the data required to calculate the indices are available from a variety of sources, these measures differ in quality, representativeness, and time period. Data on the proportions of women in union by age group are available from the 1970 Cuban census. Data on contraceptive prevalence are available from a series of community fertility surveys described above, conducted in one rural and four urban areas between 1971 and 1973. Breastfeeding data are available from a 1973 national cohort survey of infants followed until age 7 months, and therefore require crude extrapolation of the duration of breastfeeding. In contrast, age-specific fertility data and data on the abortion rate are of extremely high quality, but pertain to all women of reproductive age, rather than to women in union as specified by the Bongaarts model. Given the overlap in years, age-specific fertility data for 1972 have been incorporated in the present decomposition exercise as the mid-point of the time periods applicable to the majority of data sets (1970-73); thus, the decomposition pertains to the incipient period of the sharpest decline in Cuban fertility. Availability of effective contraceptive methods was still

comparatively limited in 1971-73 and the legal abortion rate was rising.

The Index of Marriage

The equation used is

$$C_m = \frac{TFR}{TM} = \frac{\sum f(a)}{\sum f(a)/m(a)},$$

where m(a) equals the proportion of women currently in legal and consensual union in 1970 by five-year age groups, and f(a) is a schedule of age-specific fertility rates in 1972. Official Cuban estimates of the latter apply to all births to all women aged 15-49.

Age Group	Age-Specific Fertility Rates 1972 f(a)	Proportion of Women in Union, 1970 m(a)	Age-Specific Marital Fertility Rates g(a) = f(a)/m(a)
15-19	143.8	.28	(270.0)
20-24	237.6	.66	360.0
25-29	167.9	.79	212.5
30-34	113.0	.83	136.1
35-39	66.1	.84	78.7
40-44	23.7	.82	28.9
45-49	2.7	.80	3.4
TFR	3.774		
TM			5.448

Therefore, $C_m = \frac{3.774}{5.448} = 0.693$.

Bongaarts suggests that the value of the age-specific marital fertility rate g(a) for the age group 15-19 be estimated as g(15-19) = 0.75 x g(20-24), since the direct estimate f(15-19)/m(15-19) tends to be unreliable, especially in populations with low values of m(15-19). The indirect estimate suggested by Bongaarts gives a value of g(15-19) of 270.0. The total marital fertility rate is 5.45, resulting in a C_m of .693.

The Index of Contraception

The equation used is

$$C_c = 1 - 1.08 \times e \times u,$$

where u is the prevalence of current contraceptive use (including male methods and sterilizations) among married women of reproductive age (15-49), e is the average use-effectiveness of contraception, and 1.08 is a sterility correction factor. The estimated use-effectiveness levels employed pertain to specific values recommended by Bongaarts for developing countries, based on method-specific values adapted from data from the Philippines. The schedule for developing countries was employed given the prevalence of traditional contraceptive methods in Cuba during 1971-73.

National contraceptive prevalence data for Cuba do not exist, and the actual mix of methods remains unknown. As noted above, the data available pertain to one rural and four urban areas from studies conducted between 1971 and 1973. The method-specific prevalence rates published apply to all women 15-49 in the original samples, rather than to women in union, as specified by the Bongaarts model. Thus, the method-specific prevalence rates underestimate the actual prevalence rates, and u(m) must be adjusted.

Method	Low Fertility u(m)	Moderate Fertility u(m)	High Fertility u(m)	Weighted Combined u(m)	e(m) Developing	e(m)u(m)
Sterilization	.083	.125	.051	.085	1.00	.085
Pill	.004	.000	.000	.001	.90	.001
IUD	.203	.159	.165	.177	.95	.168
Condom	.082	.114	.035	.077	.70	.054
Diaphragm	.017	.000	.000	.006	.70	.004
Foam/Cream/ Jelly	.066	.000	.000	.023	.70	.016
Rhythm	.063	.075	.031	.056	.70	.039
Withdrawal	.064	.095	.064	.074	.70	.052
Other	.000	.000	.000	.000	.70	.000
				u = .499		.419

A second methodological concern relates to the areas sampled. The data on prevalence pertain to areas of low, moderate, and high fertility. In order to obtain some estimate of prevalence at the national level, the

prevalence data by method for the three areas of Havana were averaged to represent a rough approximation of the contraceptive prevalence rate in the two provinces of lowest fertility in 1972 (La Habana and Matanzas, which had TFRs of 2.8 and 3.4, respectively). The data for Santa Clara, an area chosen to represent a moderately low fertility situation, represent a rough approximation of contraceptive prevalence in the provinces of Las Villas, Camaguey, and Pinar del Rio, with TFRs ranging from 3.6 to 3.7 in 1972. Finally, the data for Yateras represent the contraceptive prevalence rate in the province of Oriente, which had the highest TFR in 1972 (4.2); according to the 1970 census, 51.5 percent of Cuba's total population classified as rural resided in the province of Oriente.

Thus, three schedules of u(m) were calculated. Next, the data were adjusted by weighting the distributions by the proportion of all women 15-49 residing in the six provinces. According to the 1970 census, 34.9 percent of the women aged 15-49 resided in the province of La Habana and Matanzas; 31.4 percent in Las Villas, Camaguey, and Pinar del Rio; and 33.7 percent in Oriente.

The weighted value of u, corresponding to the prevalence of current contraceptive use among all women aged 15-49, was .499, and $\Sigma\, e(m)u(m)$ is .419, use-effectiveness, $e = \Sigma\, e(m)u(m)/u = \frac{.419}{.499} = .840$. However, since this derived value of u is an underestimate of the true value of u for all married women, and since the studies are limited to certain locales in Cuba, the value of .53 was substituted as an approximation of u for purposes of calculating C_c. As previously noted, on the basis of the equation ($Y = 46.9 - .42X$), it is estimated that some 53 percent of all married women of reproductive age were using contraception in 1972 (CBR of 25 in 1973). For Cuba, $u = .53$ and $e = .840$, so that $C_c = 1 - 1.08 \times .840 \times .53 = .519$.

The Index of Abortion

The formula used is

$$C_a = \frac{TFR}{TFR + 0.4 \times (1 + u) \times TA},$$

where TA equals the total abortion rate, equivalent to the total fertility rate, that is, the average number of

abortions per woman during her lifetime if present abortion levels prevailed. The data on abortion apply to all women, rather than abortions to married women as specified in the Bongaarts model. The abortion rate was calculated as the legal abortion rate (procedures per 1,000 women 15-44) in 1972, 54.9 x .03 = 1.647. Thus the estimated total induced abortion rate was 1.65 abortions per woman in 1972. Therefore,

$$C_a = \frac{3.774}{3.774 + 0.4 \times (1 + .53) \times 1.65} = .789.$$

The Index of Postpartum Infecundability

The final index, postpartum infecundability, is measured as

$$C_i = \frac{20}{18.5 + i},$$

where i is the mean duration of postpartum infecundability. Since a direct measure of i was not available, its approximate value was calculated by extrapolating the truncated breastfeeding data in Table 34, allowing a 2-percent decline in the proportion of children breastfed for every 1-month period beyond 7 months until about age 2. The mean duration of breastfeeding calculated in this manner is 6 months. Using the equation $i = 1.753 \exp(0.1396 \times B - 0.001872 \times B^2)$, $i = 1.753 \exp(0.838 - 0.067)$, or 3.79; $C_i = \frac{20}{18.5 + 3.79} = .897$.

Model Estimate of the Total Fertility Rate

On the basis of the data in Table 40, the TFR is finally estimated as $C_m \times C_c \times C_a \times C_i \times TF$ or (.693 x .519 x .789 x .897 x 15.3) = 3.89. This derived estimate is only slightly higher than the total fertility rate of 3.77 originally calculated for all women aged 15-49 and within an acceptable range of variation.

Each index takes on a value between 0 and 1. The lower the value of any index, the larger its relative fertility-modifying effect. As illustrated in Table 40--which provides measures of the intermediate fertility variables, the indices, and the total, marital, and natural marital fertility rates for Cuba--the effect of contraception is the most significant

TABLE 40 Measures of the Intermediate Fertility Variables, the Indexes and the Total, Marital, and Natural Marital Fertility Rates for Cuba, 1972, and for Countries in Phase Three of a Synthetic Transition (TFR 3.0-4.5)

Measures	Cuba	Phase III Societies[a]
Prevalence of contraceptive use	0.53	0.40
Use-effectiveness of contraception	0.84	0.86
Total induced abortion rate	1.65	0.38
Postpartum infecundability (in months)	3.79	8.50
Index of marriage	0.693	0.551
Index of contraception	0.519	0.630
Index of induced abortion	0.789	0.961
Index of postpartum infecundability	0.897	0.763
Total fertility rate	3.77	3.88
Total marital fertility rate	5.45	7.05
Model estimate of total fertility rate	3.89	--
Total natural marital fertility rate[b]	13.72	11.67

[a]The data were obtained by averaging data from four countries; see Bongaarts (1982:Table 4).
[b]Estimated as 15.3 times the index of postpartum infecundability.

(.519), followed by the effect of marriage patterns (.693). The fertility-inhibiting effects of these two factors is significantly greater than the effect of either abortion (.789) or postpartum infecundability (.897).

In 1972, the total abortion rate in Cuba was 1.65 abortions per woman; close to one-third of all known pregancies were terminated by legal abortion. Only 25-34 percent of women of reproductive age in urban areas and 22 percent in rural Yateras were currently using an effective contraceptive method (IUD, sterilization, diaphragm, or pill). The corresponding proportions relying on traditional contraceptive methods varied from 20-33 percent in the urban areas to 13 percent in Yateras. However, decomposition of the proximate determinants demonstrates that both contraceptive use and marriage patterns were more significant fertility-modifying factors than induced abortion.

The data provided in Table 40 on phase-three societies are subject to large sampling errors because of the small number of populations included in the averages. Comparisons of these societies and Cuba show that Cuba's prevalence of contraceptive use is higher, while its use-effectiveness of contraception is similar, given the high proportion of women using traditional methods at the time. However, not surprisingly, Cuba has a much higher total induced abortion rate and a shorter duration of postpartum infecundability. With respect to the indices, contraception, and especially induced abortion, are more significant determinants of the total fertility rate in Cuba than they are in other phase-three societies; marriage and postpartum infecundability are less significant.

Chapter 4

THE DETERMINANTS OF FERTILITY: ECONOMIC AND SOCIAL POLICIES AND PATTERNS

As noted above, few countries have undergone demographic changes as drastic as those of Cuba over the last quarter of a century. The factors influencing this fertility decline are complex and difficult to disentangle. This is true not only for the proximate determinants of Cuban fertility previously discussed, but also for the fertility determinants--economic and social policies and patterns. Although empirical data on these determinants are abundant, direct evidence linking these variables to fertility behavior is generally quite limited, and inferences must be drawn from the available data.

In assessing the impact of economic and social changes on Cuban fertility, it is essential to bear in mind that the revolutionary experience initiated in 1959 has radically changed many traditional institutions. However, these changes have apparently not altered many normative and behavioral patterns associated with the historical emergence of those institutions. In addition, it is critical to remember that the process of revolutionary change has been very dynamic and fluid. Significant social achievements in the areas of health services, education, and income distribution have been made under difficult economic conditions. Positive and negative developments in certain areas of social and economic life appear to have interacted in very complex ways, influencing the course of fertility through countervailing means.

The following discussion attempts to describe those policies and patterns which appear to have encouraged fertility decline, as well as the manner in which they have affected different segments of the Cuban population. First, it focuses on various postrevolutionary economic policies and patterns, analyzing trends in aggregate economic growth, income distribution, levels of material

consumption, old age security, male and female employment, and resulting time constraints. This is followed by a discussion of various social policies and patterns pertaining to education, health services, mortality reduction, and housing. Throughout the discussion, links between fertility and various policies and patterns are suggested.

ECONOMIC POLICIES AND PATTERNS

Aggregate Economic Growth

The economic changes accompanying changes in the Cuban political process over the last two decades have been dynamic, involving significant reversals in development strategies in response to economic fluctuations. These fluctuations appear in turn to have influenced, or at least to have been associated with, the nation's observed fertility patterns.

Carmelo Mesa-Lago (1981:Table 3) has provided a general description of the Cuban economy over the last two decades, as well as various statistical series that help gauge its global performance. Although highly suggestive, these series, shown in Table 41, should be regarded as only approximate since they are based on fragmentary, often incomparable data until the late 1960s and early 1970s. Moreover, according to Mesa-Lago, a particularly serious shortcoming of the series is that for several years, especially in the period since 1967, some of the income data on which the estimates are based have not been corrected for inflation and are also affected by changing methodologies (Mesa-Lago, 1981). Thus, in view of the acute worldwide inflationary pressures experienced since 1973, the data for the 1970s probably overstate economic performance.

During the first few years of the revolution, from 1959 to 1961, a generally favorable economic performance accompanied structural changes. Aggregate demand rose in response to income distribution measures resulting from agrarian and other social and economic reforms (e.g., increased employment, higher minimum wages). Other contributing factors included an expansion in government spending, use of new productive facilities constructed just prior to the revolution, and the early favorable performance of the agricultural sector (Ritter, 1974). However, as a result of higher aggregate demand, domestic and imported inventories were rapidly depleted.

TABLE 41 Economic Growth, 1962-80: Cuba

Year	Gross Material Product (GMP) (in million pesos)	Annual Rate[a] (percent)		Multi-Year Average[a] (percent)
		Total	Per Capita	Per Capita
1962	3,698.2	--	--	
1963	3,736.7	1.0	-1.6	
1964	4,076.4	9.0	6.4	
1965	4,137.5	1.5	-1.0	2.7
1966	3,985.5	-3.7	-5.7	
1967	4,081.0	2.4	0.5	
1968	4,352.6	6.7	5.0	-1.3
1969	4,180.6	-4.0	-5.6	
1970	4,203.9	0.6	-0.9	
1971	4,818.2	14.6	12.8	
1972	6,026.9	25.1	23.0	
1973	6,710.4	11.3	9.4	14.5
1974	7,414.1	10.5	8.9	
1975	8,886.3	19.8	18.3	
1976	8,881.8[b]	-0.1	-1.5	
1977	9,246.0[b]	4.1	2.9	
1978	10,115.2[b]	9.4	8.4	3.1
1979	10,545.1[b]	4.3	3.6	
1980[c]	10,861.4[b]	3.0	2.3	

[a]GMP, in 1962-66 at constant prices, in 1967-80 in current prices. Gross material product includes the production of material goods in agriculture, fishing, mining, industry, and construction and excludes the value of such material services as transportation, trade, and communication related to the production of material goods included in gross social product (GSP), and the value of nonmaterial services such as education, health care, insurance, etc.
Technically, per capita growth rates in GMP cannot be compared over time due to shifts in methodologies and the effect of inflation since 1967.

[b]Author estimate based on the average ratio of GMP/GSP in the previous 10 years.

[c]Goal.

Source: Mesa-Lago (1981:Table 3).

During these early postrevolutionary years, when the capitalist system was rapidly and almost completely reorganized along socialist principles through the collectivization of the means of production, social welfare objectives played a central role in the allocation of national resources. These social objectives involved redistributive reforms geared to reducing social and regional differentials in living conditions and providing access to basic social services. The earliest development strategy, to be implemented during the 1962-65 period, rested at first on a drive toward rapid industrialization of the country through import substitution, as well as reduction of the dependency on sugar through diversification of agriculture and the attainment of self-sufficiency in food production. In addition, there was to be expansion of education, health, and social security services, as well as various agrarian and urban reforms. This period of redistributive reforms, lasting roughly from 1959 to 1964, coincided with a rise in marriage rates (more than doubling between 1959 and 1961); it also coincided with the baby boom period, during which the birth rate increased by nearly 35 percent over its prerevolutionary rate, an increase experienced by all age groups, but especially younger women aged 15-24. As previously noted, this period was also marked by a reduction in the availability of abortion and contraception.

The evidence suggests that the baby boom was produced by the rise in real income. The latter resulted from a series of policies that led to a shift in income distribution; this shift increased incomes and reduced the cost of living and housing, especially for the lower but also the middle classes.

The most significant rural reform, the Agrarian Reform Law of May 1959, included a variety of provisions that particularly benefited former tenants, sharecroppers, and squatters.[27] In October 1963, a second Agrarian Reform law was passed which limited the area of land that could be owned privately to 66 hectares. By 1961, 59 percent of the land still remained in private ownership; by 1963, the government owned 70 percent of the national land, but only 57 percent of the arable land. However, the average annual income of private farmers in the mid-1960s was 2,450 pesos, in comparison with only 800 pesos among agricultural workers on state farms. Despite endorsement of the educational and public health policies of the government, peasant resistance to many of the government's agricultural policies resulted (Dominguez, 1978). Those

benefiting most from agrarian reform included squatters and nonsugar farmers through the reduction in land evictions and improved security of land tenure. As noted by Dominguez (1978:463):

> . . . rural educational opportunities improved remarkably; rural public health, more modestly. Rural income also rose faster than urban income during the period. In exchange for relinquishing their political autonomy, the peasants did gain important material advantages, at least until 1975, when new taxes and interest policies cancelled out many of the benefits peasants had enjoyed earlier.

In the urban areas, the most significant income distribution reform was the Rent Law of March 1959. This law provided reductions of 50 percent in the rents of those paying less than 100 pesos per month and 30 or 40 percent for tenants in the higher brackets.

In addition, minimum salaries were raised. According to one official estimate, from January 1958 to January 1961, the proportion of the labor force earning more than 75 pesos a month increased from 51.5 to 60.8 percent, and from 27.2 to 34.2 percent in the rural areas (O'Connor, 1970). It is estimated that within the same time period, wages and salaries increased between 15 and 30 percent through the renegotiation of labor contracts (Ritter, 1974). The income lost by the wealthy was transferred to the less affluent as

> . . . minimum wages and pensions were increased, overall wages [were] raised significantly (as much as 25 to 30 percent), agricultural rents were eliminated while urban rents were reduced by one-half, mortgages were abolished, and the cost of public utilities cut . . . . The policies of expansion of free social services (education, health and social security) and achievement of full employment also resulted in increases of income or disposable income of the poorest strata (Mesa-Lago, 1981:143).

Electricity, water, and telephone service rates were reduced, and important social services, especially in rural health and education, were expanded and provided free. Class and sex barriers to education were reduced

through the abolishment of private schools, the incorporation of rural students in urban schools, and the provision of government scholarship aid. All of these factors, to be discussed separately in later sections, produced immediate improvements in real income.

As previously noted, the baby boom occurred in all provinces, but was sharpest in La Habana, Matanzas, and Las Villas, highly urban provinces in central Cuba. Thus urban reforms, lowering the cost of living and promoting social mobility, together with reductions in the urban availability of fertility regulation, may have been more significant factors than agrarian reforms in the early baby boom.

By 1962, however, the development strategy plan began to falter. From 1962 to 1970, aggregate economic performance was poor. This resulted from a variety of factors: the abrupt elimination of market mechanisms through rapid collectivization of the means of production; the loss of highly skilled managerial and professional personnel through emigration; the economic embargo imposed on Cuba by the U.S. and OAS and the shift in economic relations towards the U.S.S.R. and socialist nations; inefficiencies in planning and management in new economic organizations; and the burden of military expenditures for internal defense and subversion abroad (Mesa-Lago, 1981; Ritter, 1974). Moreover, a reduction in sugarcane production, in conjunction with low sugar prices and the rapid importation of industrial equipment, resulted in a severe balance-of-payments problem.

In response, in 1963-64, a new economic strategy was developed reemphasizing sugar production and export as the major source of foreign exchange earnings. Because of difficult economic conditions, in March 1962, the government introduced a food-rationing system, which remains largely in effect today. Levels of consumption, especially of durable consumer goods, were sharply reduced as economic conditions worsened, in order to increase investment. However, the rationing of basic goods and the reduced availability of consumer goods created a growing gap between wages paid and goods for sale, resulting in problems of labor productivity. Thus, in the early 1970s, the work quota was changed, linking worker productivity to remuneration and abandoning moral incentives, as discussed more fully in the section below on income distribution.

The goal for the 1970 sugarcane harvest was set at 10 million tons of sugar, necessary for the reduction of the

foreign debt, further economic development, and improvement of consumption levels. Although a record was set, this goal was not attained. Moreover, the overcommitment of labor and other economic resources to the harvest disrupted the rest of the national economy, as males were shifted into agriculture and women were recruited to fill their positions (Ritter, 1974).

As noted in Table 41, aggregate economic growth rates in various years during the 1962-70 period were negative; on a per capita basis, output during this period was probably stagnant. On the other hand, standards of living for the marginalized social classes improved during the 1960s as wealth from upper-income groups was transferred to the poor and middle classes and as social services began to expand.

In the first half of the decade of the 1970s, Cuba's economic performance was considerably improved, and economic growth rates were exceptionally high compared to the poor performance in the 1960s. The high rates of growth during 1971-75 were largely the result of record-high sugar prices in international markets, the greater efficiency of the new model of economic planning, returns to previous investments in human and physical capital, reduced defense needs, increasing Soviet subsidies, and the postponement of payments on debts owed to the Soviet Union. In addition, an increased flow of credit from market economies resulted from the easing of trade restrictions previously placed on Cuba by the U.S. and OAS. Sugar prices on the international market soared from 4 cents a pound in 1970 to 65.5 cents in 1974, and hard currency receipts from sugar sales in the free market increased. Levels of living improved during the period as the greater availability of foreign exchange permitted the importation of consumer goods, automobiles, and household appliances, as well as capital goods from Western economies and the Soviet Union.

The worsening economic picture toward the end of the decade can be traced to a sharp drop in sugar prices in the mid- to late 1970s and reduced tobacco, sugar, and swine production due to plant and animal diseases, resulting in a deterioration in terms of trade with the West. Although the volume of exports was sustained, Cuba earned substantially less foreign exchange than in the 1970-75 period. In addition, the absence of production norms and quality controls, labor absenteeism, and the expense of overseas military involvements and new domestic defensive organizations contributed to the economic

setbacks (Mesa-Lago, 1981). Dominguez (1981:49) concluded that "even the most moderate adjustments for inflation imported from the international economic system would drastically reduce the real growth rate in four of the last five years"; that rate was estimated by Cuba as 4 percent for 1976-80, one-third lower than originally targeted (Latin America Weekly Report, February 20, 1981).[28]

Income Distribution

As noted above, the early years of the revolution saw a swift redistribution of income and wealth. In relative terms, this early income transfer disproportionately benefited the least privileged strata, although middle-income groups also benefited. Between 1962 and 1973, a further but far less dramatic shift in income took place. Crude estimates of these income distribution patterns are shown in Table 42. As noted in the table, the share of personal income received by the poorest 40 percent of the population nearly tripled between 1953 and 1962, from 6 percent in 1953 to 17 percent in the early 1960s, rising

TABLE 42 Estimates of Income Distribution, 1953-73: Cuba

Per Capita Income Quintiles[a]	Family Income		Personal Income		
	1958	1962	1953	1962	1973
0-20	5.7	9.5	2.1	6.2	7.8
21-40	8.9	12.2	4.1	11.0	12.5
41-60	12.5	13.5	11.0	16.3	19.2
61-80	18.3	18.3	22.8	25.1	25.5
81-100	54.6	46.5	60.0	41.4	35.0
Total	100.0	100.0	100.0	100.0	100.0

[a]Income quintiles are ranked from lowest to highest.

Sources: Family income: MacEwan (1981:Table A.1.1). Personal income: Brundenius (1979:Table 12). See also Mesa-Lago (1981: Table 37). Original 1962 personal income figures are revised in Brundenius (1981:Table 6).

slightly to 20 percent by 1973. The total income share of middle-income groups, according to personal income estimates, rose from 34 percent in 1953 to 41 percent in 1962, and continued to rise somewhat until 1973 (45 percent). The data on family income indicate similar trends.

It is worth noting, first, that these estimates do not take into account the regional equalization of free social services (health, education, and other services), which were greatly expanded after 1959. Since access to these services is not dependent on level of income, low-income groups benefited disproportionately from these changes. Second, the income distribution figures do not consider that, given the prevailing rationing system and subsidizing policies, the prices of many basic items in state stores remained below their real cost over many years. Third, the income distribution figures do not convey the change in the volume of income being redistributed, or the growth of gross domestic product in the immediate postrevolutionary era in contrast to the period of the mid-1960s, when it may have declined in absolute size. Thus, in real terms, the transfer of income from rich to poor and middle-income groups would appear to have been more substantial than that suggested by Table 42, especially during the early revolutionary period.

By 1970, however, it became evident that income redistribution measures were beginning to have adverse effects, impairing the growth of the Cuban economy. Expenditures for social programs increased the size of the foreign debt. Policies of full employment were maintained at the expense of lower labor productivity and higher absenteeism (MacEwan, 1981). In 1971, therefore, the Cuban government initiated a change in government policy labeled as the Soviet Economic Reform Model (Mesa-Lago, 1981). One of the principal aims of this policy change was establishment of a system of material incentives to combat absenteeism and raise labor productivity. Wage subsidies and programs of labor mobilization were curtailed, and a Soviet-type system of performance quotas and more sharply differentiated wage scales was introduced. Charges for utilities, formerly provided free, increased availability at higher prices of non-essential consumer goods, tighter domestic budgets, and even some reemergence of unemployment resulted.

The 1980 wage reform introduced further monetary incentive schemes. Under this new system, wages were tied to productivity, overfulfillment of work norms, and

work under difficult conditions. In addition, piecework payment methods were applied to the sugar and food ministries.

The impact of these policies can be assessed only indirectly. Brundenius (1981) concludes that income differentials had narrowed considerably by 1973 and may have stabilized. That year, the average agricultural wage was 1,416 pesos per year, approximately 93.5 percent of the national average and 88 percent of the industrial average. By 1978, however, the income gap among the three sectors had again increased, with the average agricultural wage equaling approximately 81 and 73 percent, respectively, of the national and industrial averages.

In conclusion, it appears that income redistribution, which stimulated higher fertility in the early 1960s, stabilized during the early 1970s. By the late 1970s, income differentials between agricultural and industrial workers had probably widened. The effect of the 1980 wage reform and incentive payment scheme cannot be assessed. Income differentials and regional disparities in income still remain in Cuba, although they are far less dramatic than those of the prerevolutionary era, especially given regional equalization of free social services, high employment levels, social security, and the prevailing rationing system. On the other hand, countering the egalitarian tendencies promoted by rationing, price supports, and free social services are the operation of black and officially sponsored "parallel" markets and periodic price increases, discussed more fully below.

Levels of Material Consumption

As indicated above, in relation to existing demand during the last two decades, Cuba has experienced a shortage of consumer goods resulting from a complex interplay of many factors: inefficiencies of the Cuban economy; priority investment of national resources in productive areas (roads, port and agricultural facilities, factories) at the expense of current consumption; and a more equal distribution of income and the consequent greater demand for goods. Rationing subsidies and price fixing have been used partly to ensure a more equitable distribution of basic necessities and consumer goods in short supply and partly to provide a substitute for the free play of market forces (Dominguez, 1978; Mesa-Lago, 1981; Ritter,

1974). The inevitable result has been a flourishing black market in which many of the goods in short supply can be purchased, but at very high cost.

In 1973, both to counteract the black market's undermining effects on moral and ethical values and to increase labor productivity, the government established a parallel market system. In this system, many consumer goods unavailable through rationing, or quantities of rationed goods beyond established limits, could be purchased, but at highly inflated prices (Mesa-Lago, 1981). The government first raised prices on alcoholic beverages, then on cigarettes and tobacco products and gasoline. Prices for everything, with the exception of some food, medicine, and essential clothing, were raised and became unsubsidized by the mid-1970s as a result of increased production. (Prior to this time, the prices of most consumer goods had been subsidized by the government.)

Tables 43 and 44 provide a limited perspective on the extent of the rationing system and on prices of various goods in the rationed, parallel, and black markets during different time periods. Although a number of consumer staples have been rationed and marketed at subsidized prices, rations may have been insufficient to satisfy family needs. Most essential clothing has remained rationed, for example, a pair of pants, a skirt, a blouse, a dress, a pair of leather shoes, and four meters of fabric annually. Monthly allocations of food and other items are, in some cases, quite low, especially if one considers some of the traditional Cuban consumption preferences. Moreover, regional differences in food consumption were still particularly marked in 1978 and 1979, the only years for which data are available: per capita food consumption in Havana was nearly one-third higher than the national average and 79 percent higher than in the poorest province, Guantanamo (Brundenius, 1982).

In line with the increasing emphasis on economic incentives, the government also established the small farmers' free market (mercado libre campesino) in 1980. Under the aegis of the local authorities (poder popular), small landholders or cooperatives of private farmers are permitted to sell their produce to the public in new markets once their commitment of sales to the state has been fulfilled. Originally, the state did not interfere with the prices, which often fluctuated greatly, but were usually below the previous black market prices. As a result of the new policy, fruit, vegetables, chicken, and

TABLE 43 Monthly Per Capita Quotas of Selected Rationed Consumer Goods (in pounds), 1962-79: Havana, Cuba

Selected Rationed Goods	1962	1969	1971-72	1978-79[a]
Meat[b]	3	3	3	2.5
Fish	1	2	4	free[c]
Rice	6	4	3-6	5
Beans	1.5	1.5	1.5-3	1.25
Tubers	14	9	n.a.	n.a.
Fats	2	1	2	1.5
Eggs (units)	5	15	15-24	free
Butter	0.125	0.125	free	free
Coffee	1	0.375	0.375	0.125
Milk (canned)[d]	6	2	3	3
Sugar	free	6	6-4	4
Bread	free	15	n.a.	15
Cigarettes (package)	free	4	4	4
Gasoline (gallon)	free	n.a.	n.a.	10
Detergent (medium pkg.)	1	1	n.a.	0.5
Soap (cake)	2	2.5	n.a.	1.5
Toilet paper (roll)	free	1	n.a.	1
Toothpaste (sm. tube)	1	1	n.a.	0.33
Cigars (units)	free	2	4	4
Beer (bottle)	free	1	free	free

[a]Also free in 1978-79 were macaroni, spaghetti, butter, and yogurt; cakes and vegetables (according to season); and bread (after 4 p.m.).
[b]Beef; if not available, chicken is provided.
[c]Small fish; seafood has not been available for more than a decade.
[d]Children under age 7 have a daily ration of half a liter of fresh milk; adults over age 65 receive six cans of condensed or evaporated milk monthly.

Source: Mesa-Lago (1981:Table 41).

some meat, normally in scarce supply in shops, became more widely available (Latin America Weekly Report, July 18, 1980). Recently, however, the operation of these free markets has been curtailed because of government claims that they have encouraged profiteering.

By the early to mid-1970s, several goods whose production had been very restricted in the 1960s were reintroduced at substantially higher prices. These included cosmetics, perfumes, cameras, and electrical appliances--radios, televisions, and refrigerators.[29] However, many of these goods--some electric appliances, for example--could only be purchased at high parallel

TABLE 44 Prices of Selected Goods (in pesos), 1977-78: Cuba

Goods	Official		
	Rationing	Parallel Marketing	Black Market
Food (pounds)			
Beef	0.44-0.55		8
Ham	1.30-2.70	6.00	10
Rice	0.21		2
Beans	0.18-0.20	1.25	2-3
Coffee	2		10-20
Fats	0.22-0.30		3
Manufactures			
Rum (bottle)		7.50-12	25[a]
Cigarettes (package)	0.20	1.60-2.00	1[a]
Cigars (one)	0.12	1.50	2[a]
Shoes (pair)	3.50-10.50		70
Fabric (meter)	0.40-2.50	1.50-10.50	30
Gasoline (gallon)	0.60	2	1
Consumer Durables[b]			
TV (black and white, 17")		650-900	
Refrigerator (sm., med.)		650-850	
Record player		350-1,200	
Car (Soviet Fiat)		4,500	
Car (U.S., 1950s)			5,000-15,000

[a]Goods of higher quality than those available through rationing or the parallel market.

[b]Most available only through quotas to state enterprises; a few available through the parallel market.

Source: Mesa-Lago (1981:Table 42).

market prices, which far exceeded the average monthly Cuban wage in 1978 of 140 pesos.[30]

Moreover, there have been a number of pricing policy reversals since the mid-1970s designed to stimulate worker productivity. Under the new policies, charges have been levied for many services and goods that for years had been provided free or at very reduced cost. These include food, clothing, and footwear for children

in day-care facilities (Recarte, 1980); electricity and water; long-distance travel and vacation plans; and meals in restaurants, as well as in worker canteens (Dominguez, 1978). Housing rents have also been increased, but remain set at a maximum of approximately 10 percent of income.

In addition, in late 1981, reforms were announced that increased the price of rationed goods such as milk, rice, beans, sugar, cooking oil and fat, beef, chicken, cloth, soap, cigarettes, and gasoline. The prices of these goods still remain moderate since government subsidies continue, but at a lower rate. In addition, the reform introduced low admission charges to museums, zoos, art galleries, and botanical gardens. Plans were also announced for sharp increases in bar, cafeteria, and restaurant prices; in many cases, proposed prices were to have doubled, although the increases were officially to have been in the range of 11 to 30 percent. However, opposition by trade unions, mass organizations, and the Havana Provincial Assembly of People's Power has led to a suspension of these latter increases pending further study by a commission that includes representatives of unions and mass organizations; other price increases are now in effect (Latin America Regional Reports: Caribbean, January 15, 1982).

Complete itemization of the costs of children assumed by the state and by parents is impossible. Despite price supports and free social services for health and education, during the 1970s only about 3 percent of primary school children received scholarships covering most of their needs (food, clothing, and lodging); this was similar to the level of scholarship aid during the 1960s. Sliding-scale charges for the use of child care centers have also been levied since the mid-1970s to discourage admission of children followed by high absenteeism. Moreover, food, clothing, and footwear for these children and school uniforms for scholarship students must now be purchased. Government assistance has instead been directed to intermediate levels of education. In 1979-80, 38 percent of basic secondary school students, 61 percent of preuniversity students, and 47 percent of technical and professional students were receiving scholarships; the proportion of all students receiving scholarships (excluding preschool, juvenile, special education, and adult education) increased from 8.5 percent (167,592 scholarships) in 1970-71, to 13 percent (303,899 scholarships) in 1974-75, to 20 percent (569,965 scholarships) in 1979-80.

Reductions in infant mortality and the high life expectancy achieved in Cuba, examined more fully below, indicate that the basic food, clothing, and health needs of the population are being met through the health system, rationing, and state-subsidized prices in the parallel market. Although minimum wage scales and unemployment insurance are sufficient to maintain an adequate standard of living, parents must provide what is not readily accessible through the rationing system, and Cuban households, like those in all other countries, must allocate expenditures among children and other goods. There may be a link between these economic factors and the low fertility desires expressed in the 1979 National Demographic Survey and discussed above, especially among lower-income groups more affected by the rise in the cost of living. These lower desires may be partly traceable to high prices charged in parallel and especially black markets on non-essential goods or quantities of rationed goods beyond established limits, to charges for services formerly provided free, and to stabilization and probable reversals in income differentials since 1973.

Empirical support for this economic influence on fertility decline is scattered and inferential. One exploratory study, recently published in a Cuban public health journal, provides extremely limited evidence (Gonzalez Perez, 1981). The study was conducted between December 1978 and June 1979, while its author was working in the sugar harvest in a rural area with a group of young male workers, all from the city of Havana. Only one-third lived in nuclear families, and one-third had employed wives; the majority had only one child. Of the 15 married men in this small sample, 13 indicated that they did not want more children because of housing problems; 12 also gave insufficient income as a reason. Of the fathers earning 150 pesos a month or less (below average wage), 73 percent stated that they did not earn enough to satisfy the needs of their families, although the number of household members supported was not specified. Marital instability was cited by 2, and difficulties in obtaining space in child care centers by 2 others. Among the 10 single men also queried, the majority cited the housing shortage as their primary reason for postponing marriage.

There are no data on the factors underlying fertility desires other than those in the 1979 National Demographic Survey; data on ideal family size collected in the early fertility surveys of the 1970s have never been published (Alvarez Vazquez, 1975). However, further evidence on

economic conditions is provided by a few independent studies conducted in Cuba in the late 1960s, involving detailed field work (Butterworth, 1980; Lewis et al. 1977a, 1977b). Although food rationing had been in effect for 20 years, regional differences in food consumption still existed in 1978 and 1979, the only years for which data are available. Similarly, the main sources of tension reported by Cuban psychiatrists are problems posed by transport, housing, and food shortages, weakened family ties, and the boredom of Cuban life (Pisani, 1980). In a survey of recent emigres arriving in the United States in the early 1970s, 96 percent of the sample stated that one of their reasons for leaving Cuba was "a lack of future" in fulfilling social and economic aspirations for self and children (Portes et al., 1977:17).

Old Age Security

Cuba's postrevolutionary policies, such as those of full or nearly full male employment, age restrictions on employment, and a more equitable income distribution, have reduced the economic value of children as labor sources, especially in rural areas. Their value as sources of old age security has also been reduced by the social security and pension policies of the government. As Mesa-Lago (1981:169) notes:

> Social security has improved significantly under the revolution, both in terms of overall coverage and distribution. In 1958 about 63 percent of the labor force was covered for old age, disability, and survivors insurance while all the labor force was covered against occupational accidents and diseases, and female employees had maternity insurance. At the eve of the revolution, Cuba had the second highest social security coverage in Latin America. Protection, though, was rather unequal because there were fifty-two autonomous social security funds--each with its own insured group, legislation, financing sources, and benefits. High status occupations normally had the best funds and conditions, while low status occupations had the worst; for instance, minimum pensions fluctuated from 30 to 200 pesos a month and maximum pensions from 60 to 400 pesos a month. There was neither national health insurance nor unemployment compensation.

The figures in Table 45 show clearly the expansion of the social security system, even after allowing for population growth. In fact, the increase in coverage for the poorest strata of the population is actually somewhat greater than these figures suggest since many former recipients of national pension funds have emigrated to the United States and other countries. A disproportionate number of these emigrants were in or near retirement age: approximately 12 percent of emigrants between 1960-67 and 1970-79 were age 60 and above (Comite Estatal de Estadisticas, 1980).

The average monthly pension per capita has only risen from 62 pesos per month in 1959 to 65 in 1978. For each additional year of employment, increments of 1 percent are added to pensions, to a maximum of 5 percent. How-

TABLE 45 Social Security Expenditures and Pension Per Capita (in current pesos), 1959-78: Cuba

Year	Total Social Security Expenditures[a] (in million pesos)	Subsidies and Welfare[b] (in million pesos)	Pension[c] (in million pesos)	Number of Pensioners[d] (in 1,000s)	Pension per Capita[d] (in pesos)
1959	114.3		114.3	154	740
1960	124.3		124.5	170	732
1961	150.5		150.5	210	727
1962	151.9		151.9	213	713
1963	177.0		177.0	250	708
1964	235.7	39.1	196.6	280	702
1965	249.8	41.5	208.3	298	699
1966	247.0	41.7	205.3	298	689
1967	245.3	38.0	207.3	301	688
1968	308.9	85.0	223.9	334	670
1969	393.9	118.2	275.7	342	806
1970	440.7	154.2	286.5	363	790
1971	486.5	175.4	311.1	394	790
1972	514.5	170.5	342.9	432	796
1973	554.4	171.1	383.3	470	816
1974	553.4	136.2	417.2	507	823
1975	585.4	137.2	448.2	544	824
1976	609.4	136.2	473.2	581	814
1977	626.0	134.5	491.5	629	781
1978	647.6	140.1	507.5	652	778

[a]Only monetary payments; excludes costs of health care provided by the Ministry of Health.
[b]Includes payments to the partially disabled; those suffering illness and accidents, both common and occupational; maternity leave and female employment; former landowners; workers who are studying; relatives of military recruits; and those who cannot afford the cost of meals in workers' cafeterias.
[c]Includes pensions for old age, disability, and survivors.
[d]1960-67 figures are Mesa-Lago's estimates checked with the State Committee on Labor and Social Security.

Source: Mesa-Lago (1981:Table 45).

ever, employment among the elderly has declined during the 1970s. Retirement became more flexible by 1971, and the number of individuals retiring increased sharply between 1972 and 1976. The average monthly pension is considerably lower than the average monthly salary (140 pesos per month in 1978); moreover, as noted above, shortages exist in goods at subsidized prices in the conventional market, and high prices are commanded in the parallel and black markets. However, health care is free, and 63 homes for the aged are provided by the state, although intergenerational housing arrangements are still comparatively common because of the housing shortage.

No data are available directly linking old age security to fertility decline. It would appear, however, that the economic value of children as a source of old age security has been considerably reduced, although not completely eliminated, by the social security and pension policies of the government.

Male Employment

The evolution of employment policies is crucial to a study of the determinants of fertility. Social policies oriented to maintaining full or nearly full male employment, in conjunction with age restrictions on employment, may have produced important changes in the perceived economic value of children, especially in rural areas.

In prerevolutionary Cuba, unemployment and underemployment were severe. In the late 1950s, according to some estimates, 10 percent of the labor force could not find work at the peak of the seasonal cycle of economic activity, and 23 percent were unemployed during the worst of the slack season (CEPAL, 1980). Beginning in the early 1960s, a number of measures were implemented that over time have helped to ease the unemployment problem. As a result, unemployment rates (see Table 46) fell from 13.6 percent in 1959, to 6.5 percent in 1965, to 2.9 percent in 1969; by 1970, unemployment had reached its lowest official recorded level of 1.3 percent, although problems of labor productivity and labor shortages had become more apparent. The goal of full male employment culminated in 1971 with passage of the "anti-loafing" law, establishing compulsory employment for adult males. Under this law, the minimum age of employment is 17 for males and females; retirement age is 55 for females and

TABLE 46 Labor Force, Female Employment, and Unemployment, 1957-79: Cuba

Year	Labor Force (in 1,000s)[a]		Unemployment (in 1,000s)		Percent	Number of Females Employed (in 1,000s)		Percent Female in the Labor Force		
1957	2,214		275		12.4	277		12.6		
1958	2,218		262		11.8	290		13.1		
1959	2,551		307		13.6	--		--		
1960	2,276		269		11.8	--		--		
1961	2,338		242		10.3	--		--		
1962	2,401		215		9.0	--		--		
1963	2,431		198		8.1	--		--		
1964	2,456		185		7.5	--		--		
1965	2,490		163		6.5	--		--		
1966	2,508		155		6.2	--		--		
1967	2,549		135		5.3	--		--		
1968	2,579		110		4.3	407		15.8		
1969	2,608		75		2.9	435		16.7	22.9[b]	
1970[c]	2,638	2,631	34	35	1.3	474	475	18.0	23.8	
1971	2,652		55		2.1	475		17.9	22.9	
1972	2,680		64		2.4	479		17.9	21.8	
1973	2,795		84		3.0	535		19.1	24.0	
1974	2,869		111		3.9	590		20.6	24.0	
1975	2,923		90		3.1	647		22.1	28.0	
1976	2,974		85		2.8	705		23.7	--	
1977	3,075		60		2.0	735		23.8	--	
1978	3,140		40		1.3	761		24.2	30.0	
1979[c]	--	3,458	--	59	--	--	946		31.0	28.9

[a]Cuba does not regularly publish data on the total labor force or unemployment. The available data are based solely on the state civilian employment and private employment, omitting the armed forces, police, and security personnel. The data on labor force represent a reconstruction of the labor force, including state, civilian, and military employees, private employees, and the unemployed (Mesa-Lago, 1980).

[b]Second series on percentage female in the labor force 1957-75 (Dominguez, 1978:Table 12.4; Benglesdorf and Hageman, 1974). Data for 1978-79 supplied by the Frente Feminino, 1980. According to their figures, 778,000 women were in the labor force in 1978 and 800,000 in 1979. The labor force is defined as the number of people engaged in salaried work during the week preceding the survey. The data for 1969-73 and 1978-79 refer to nonmilitary employees of the state; data for 1974-75 include all employment.

[c]Unemployment was calculated as the difference between the economically active population and the population defined as in the labor force, that is, having worked during the week preceding the survey.

Sources: Unless where otherwise stated, Mesa-Lago (1981:Tables 30, 32). Data for 1970 and 1979, Comite Estatal de Estadisticas (1981d).

60 for males. All male citizens from 17 to 60 who are fit to work and are not attending any of the schools in the national system of education must seek employment or join the armed forces at age 17.

The year 1970 is important in an analysis of Cuba's employment policies since it marks a shift from the earlier concept of the "new man," dominated by moral incentives, to an emphasis on monetary incentives for work produced (Mesa-Lago, 1981; Recarte, 1980). This shift followed the unsuccessful attempt in 1970 to produce ten million tons of sugar. According to Mesa-Lago (1981:192-193), a number of previous policies were reversed:

> . . . material incentives [were] substituted for moral incentives; wage differentials [were] expanded; wage scales were reintroduced and connected with work quotas; overtime and production bonuses were reinstalled; expansion of free social services was frozen and in some cases reversed; durable consumer goods became distributed mainly based on work performance . . . . In the current stage, not only has there been a return to the principle of distribution according to work, but also an attempt to reestablish the connection between labor reward and enterprise productivity and profitability.

This increased labor productivity conflicted with Cuba's full employment policies. The solution to this dilemma during the 1970s was a series of measures that, in effect, tended to reduce the size of the domestic labor force. Retirement became more flexible in 1971, and the number of individuals retiring increased sharply between 1972 and 1976.

In 1973, the Confederation of Cuban Workers agreed to modify regulations originally passed in 1967 when the manpower deficit was acute; these regulations had reserved for women certain types of service jobs so that men could be transferred into more physically strenuous work, especially in agriculture. In 1976, the number of jobs from which women were barred for health or safety reasons was also expanded, opening these positions to men. In addition, the armed forces were expanded from an estimated 185,000 men in 1974, at the time of peak unemployment, to 230,000 in 1978. Finally, professionals in abundant supply, such as teachers, physicians, dentists, and

related health personnel, were exported to assist developing nations and to generate revenue for the state (Mesa-Lago, 1981).

By the end of the 1970s, however, a labor surplus existed, with unemployed workers receiving 70 percent of their wage while waiting for job reassignment. In 1979, an estimated 59,000 males were unemployed.[31] Since October 1980, all employees have been required to sign individual contracts with the state enterprise for which they work. Previously, most workers with steady jobs simply became part of a permanent roster of employees without a written contract defining their legal position.[32]

Table 47 shows the distribution of the male employed population by economic sector in 1979. Males were concentrated in the agricultural and mining sectors (28.3 percent of all male employees), industry (22.9 percent), construction (10.6 percent), and transportation and communication (7.9 percent), with the remainder distributed among the other sectors. As noted in Table 48, which presents the distribution of the male employed population by occupational status, one-third of Cuban male laborers were classified as nonagricultural; approximately 20 percent were agricultural laborers, 20 percent were service laborers, and 28 percent were in professional, technical, managerial, and administrative positions.

A perspective on the association between male occupational status and fertility is offered in Table 49 and Figure 17, which show differentials in total fertility rates over time by occupational status of the head of household, cross-classified by wife's educational attainment. The data on current occupation collected in the 1979 National Demographic Survey are classified into four categories: agriculture; manufacture and production of goods; service activities; and professional, managerial, and administrative activities. Data on total fertility rates, calculated through use of the own-children methodology, are presented for two time periods--one of high fertility (1964-66) and one of low fertility (1976-78). As noted in the first two columns of the table, the decline in total fertility rates occurred within all occupational categories, but was especially sharp among agricultural workers (both laborers and small landholders), who evidenced a decline in total fertility of 3.4 to 3.5 children during the time period in question. Declines in the other groups were lower, ranging from 2.8 children among production workers and 2.5 among service

TABLE 47 Employed Population, by Sex and Sectoral Economic Activity, 1979: Cuba

Sectoral Economic Activity	Male		Female		Employment Distribution by Sex (percent)[b]	
	Absolute (in 1,000s)	Percent[a]	Absolute (in 1,000s)	Percent[a]	Male	Female
Industry	497,2	22.9	154,7	17.9	76.3	23.7
Construction	230,0	10.6	26,5	3.1	89.7	10.3
Agriculture, mining	614,5	28.3	101,5	11.7	85.8	14.2
Transportation, communication	171,3	7.9	31,4	3.6	84.5	15.5
Commerce	154,8	7.1	110,7	12.8	58.3	41.7
Other productive activities	4,5	0.2	3,2	0.4	58.2	41.8
Services, public and private	62,8	2.9	31,9	3.7	66.3	33.7
Education, culture, and art	147,3	6.8	226,5	26.2	39.4	60.6
Public health, social security, sports, and tourism	55,3	2.6	93,4	10.8	37.2	62.8
Other unproductive activities	232,0	10.7	84,8	9.8	73.3	26.8
Unspecified activities	134,6		81,4		65.5	34.5
Total	2,324,3	100.0	946,0	100.0	71.1	28.9

[a]Percent distributions exclude persons employed in unspecified activities.
[b]Percent distributions refer to the employment distribution by sex within each sectoral activity.

Source: Comite Estatal de Estadisticas (1981d:Table 16).

TABLE 48 Population Employed, by Sex and Occupation, 1979: Cuba

Occupation	Both Sexes		Male		Female		Employment Distribution by Sex (percent)	
	Number (in 1,000s)	Percent	Number (in 1,000s)	Percent	Number (in 1,000s)	Percent	Male	Female
Professional and technical	534,4	17.5	248,9	11.4	285,5	32.6	46.6	53.4
Managerial	111,1	3.6	92,7	4.3	18,4	2.1	83.4	16.6
Administrative laborers	198,8	6.5	64,2	3.0	134,6	15.4	32.3	67.7
Services laborers	609,1	20.0	360,8	16.6	248,3	28.4	59.3	40.8
Agricultural laborers	614,2	20.1	544,5	25.0	69,7	8.0	88.7	11.4
Nonagricultural laborers	985,7	32.3	867,2	39.8	118,5	13.5	88.0	12.0
Unspecified	217,0	--	146,0	--	71,0	--	67.3	32.7
Total	3,270,3	100.0	2,324,3	100.0	946,0	100.0	71.0	28.9

Source: Comite Estatal de Estadisticas (1981d:Table 14).

TABLE 49 Total Fertility Rates, by Occupational Category of Head of Household and Wife's Educational Attainment, 1964-66 and 1976-78: Cuba

Occupational Category	TFR		Education							
			0-3		Primary 4-5		6		Intermediate	
	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78
Agriculture[a]			7.2	3.7	5.6	3.6	5.2	2.5	4.8	2.0
Laborers	6.3	2.9								
Small holders	5.8	2.3								
Manufacture and production of goods[b]	4.9	2.1	6.3	3.0	5.2	3.4	4.5	2.7	3.7	1.7
Service activities[c]	4.5	2.0	6.0	2.8	5.1	2.8	4.2	2.6	3.3	1.8
Professional, managerial, and administrative activities[d]	3.6	1.9	--	--	5.3	3.1	3.9	2.8	2.9	1.5

[a]Persons employed in the agricultural sector, mining, fishing, and hunting, including the unremunerated family worker. The group is subclassified into state and private salaried workers; small agricultural landholders; and cooperative workers.

[b]State and private salaried workers employed in the production and manufacture of goods (including transportation), in which physical work predominates (includes agriculture, mining, fishing, and hunting activities).

[c]State and private salaried workers employed in services (communication, commerce, food, sanitation and cleaning, personal services, and public protection, etc.) and unclassifiable workers.

[d]State workers employed in occupations in which intellectual work predominates (includes managers, planners, engineering and technology, education, research, culture and art, public health, journalism).

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 16).

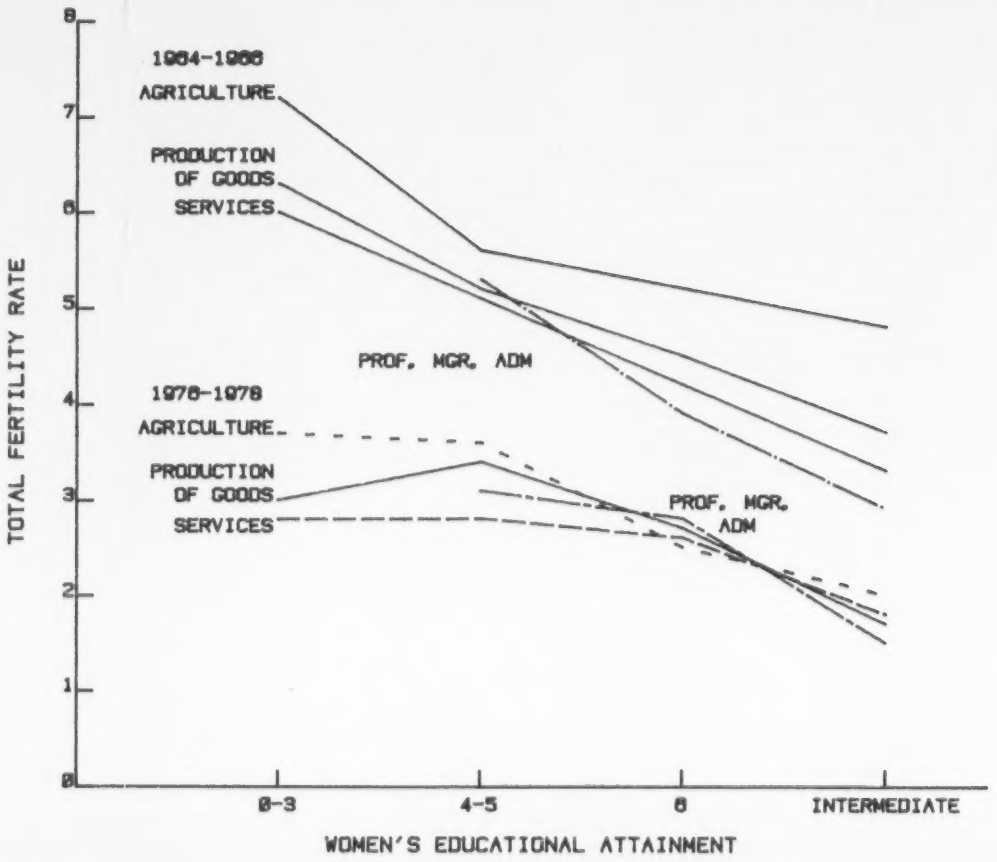

FIGURE 17 Total Fertility Rates, by Occupational Category of Head of Household and Wife's Educational Attainment, 1964-66 and 1976-78: Cuba

workers to 1.7 among professional, managerial, and administrative workers. By 1976-78, there was comparatively little difference in fertility by occupational category (TFRs ranging from 1.9 to 2.3), with the exception of agricultural laborers, who still evidenced the highest fertility (TFR of 2.9).

The same data cross-classified by wife's educational attainment demonstrate similar trends. In 1964-66, the agricultural occupations within every educational group had the highest fertility, ranging from 7.2 children among those with less than 3 years of education to 4.8 among those with intermediate levels of education. By 1976-78, this differential remained only within the occupational category of 0-3 years of education. Heads of households engaged in agriculture whose wives had 0-3 years of education had 3.7 children, in comparison to 3.0 among production workers and 2.8 among service workers. At the other educational levels, differences are considerably narrowed (.3 to .5 children in 1976-78); within one educational category (primary school completed), agricultural laborers and landholders had the lowest fertility.

As discussed further below, rural fertility was also higher than urban at the beginning of the time period; however, by the late 1970s, rural-urban differentials remained only among women with the lowest educational attainment. Thus, occupational category does not appear to be a significant differential in Cuban fertility. Differentials in fertility that do exist are explained by differences in educational level and, to a lesser extent, by rural-urban differentials (Comite Estatal de Estadisticas and CELADE, 1981).

Female Employment

Cuban women had achieved a relatively high status prior to 1959. They were granted the right to vote in 1934, while the very progressive 1940 constitution prohibited discrimination on the basis of sex and required equal pay for equal work. According to the 1953 census, there were somewhat fewer female than male illiterates (21 percent in comparison to 26 percent among males), more females than males over age 10 who had received formal schooling (77 percent in comparison to 72 percent among males), and a high proportion (32 percent) of the economically active female population employed in white-collar occupations.

Since 1959, various government policies have further improved the status of women in accordance with the economic and social objectives of the government. These policies have included literacy and adult education programs, mobilization for volunteer work, and incorporation of women into the full-time labor force. These efforts have successfully modified many previous social relationships, although there has been some cultural resistance. For instance, male opposition to state interference in family relationships, such as boarding schools for children and female employment, has been cited as an important factor in emigration from Cuba during the late 1960s (Fox, 1973).

It is within this complex context of economic policy that female labor force participation should be analyzed. During the 1960s, when the social goal of reducing male unemployment received priority, the incorporation of women into the labor force was not regarded as crucial. As labor shortages began to appear during the mid- to late 1960s, women began to be used increasingly as a reserve labor force pool, mobilized for short-term, voluntary work, with efforts made to modify cultural attitudes toward women's roles and employment. As part of its activities, the Federation of Cuban Women (FMC) broadened its functions in 1964 to form volunteer women's work brigades on a regular basis. The FMC reported that between 1972 and 1973, for instance, there was an increase from about 76 million to more than 95 million hours of voluntary work by women (Benglesdorf and Hageman, 1974). A wide variety of activities were included in this voluntary labor, including cane cutting, literacy and adult education programs, health activities, and work in various mass organizations.

Although women were used primarily as reserve labor during the 1960s, notable shifts occurred in their areas of employment, coinciding with increases in social services and commerce and decreases in personal services. According to the 1970 census, only 18.3 percent of the economically active population aged 15 and older was female (approximately 480,727 women), a rate exceeded by many other Latin American countries and only a small increase from the 1953 figure of 13 percent (256,440) among those aged 14 and older (Republica de Cuba, 1955, 1975). After social services, in which 42 percent of the economically active women were engaged in 1970 (predominantly in health and education), the only other important sectors of employment were commerce and manufacturing

(textiles, food, tobacco, and handicrafts). The proportion of women employed in commerce also increased from 7.9 percent in 1953 to 19.7 percent in 1970, reflecting the government policy mentioned above designed to transfer males employed in commerce to other sectors of the economy, especially agriculture, and replace them with females. The proportion employed in social services had increased from 29.2 percent to 42 percent, while the proportion employed in personal services had declined from 35.5 percent in 1953 to 3.3 percent in 1970. This shift from personal to social services reflects an expansion of health and education; socialization of the remaining small businesses in 1968; and a reduction in the incidence of private domestic service, as well as its omission from the 1970 census definition of economic activity (Alvarez and Rodriguez, 1978). Female employment in agriculture, which is usually underenumerated, increased from 14,600 in 1953 to 38,649 in 1970; however, it still played only a minor role in total female labor force participation (less than 6 percent in 1953, 8 percent in 1970). Given this shift toward higher-status social service employment, the opportunity costs of female economic activity can be expected to have risen.

Table 50 presents a variety of data pertaining to age- and marital-status-specific female economic activity. As noted, in 1970 only 18 percent of all women aged 14 and above were economically active. The low proportion employed among women aged 15-19 reflects enrollment in secondary education. Employment is instead concentrated in the reproductive years: approximately one-fifth to one-fourth of the women in the five-year age groups from 20 to 44 were economically active in 1970. The proportion economically active drops sharply after age 50; the low rates for women aged 60-64 reflect social security provisions.

Although not shown in tabular form, the proportion of women economically active in 1970 was higher in urban than in rural areas, except in the age group 10-14. This is perhaps due to earlier abandonment of studies in rural areas (CELADE, 1979), although age-specific economic activity rates of women in rural areas were higher in 1970 than in 1953. At the national level in 1970, two-thirds of all women resided in urban areas, which contained approximately four-fifths of the economically active female population.

Because of persistent labor shortages and a policy of expanding the labor force to increase aggregate economic

growth, more concerted efforts were made in the late 1960s to raise the levels of female labor force participation. Between 1969 and 1972, in anticipation of the big sugar production push, a goal of incorporating 100,000 women a year into the full-time labor force was established. However, there was also a high attrition rate, with two out of three women who entered the labor force withdrawing soon thereafter. Social surveys conducted in the early 1970s identified the underlying causes of this high attrition rate. These included inflexible work schedules (usually only full-time employment for 5 and 1/2 days per week is available); discrimination in promotion; limited child care facilities; a shortage of services that facilitate employment, such as home appliances, laundries, and prepared foods; elimination of domestic service as an occupation; and husbands' attitudes that created the double burden of employment and domestic tasks for employed women (Departamento de Orientacion Revolucionaria, 1976).

As a result of the attrition rate, to achieve an increment of approximately 197,000 female workers in the period 1969-74, it was reportedly necessary to incorporate 714,000 women (Departamento de Orientacion Revolucionaria, 1976). To support these efforts, the State provided widespread access to contraception and abortion, as well as legal statutes ensuring equal pay scales and maternity leave. Free compulsory primary and secondary education for children, boarding schools, and scholarships also shifted some child care tasks from parents to the state. During the early to mid-1970s, there were also reversals in some policies related to promotions for women, preferential access to goods and services for employed women, and provision of day care (Hollerbach, 1980b). For instance, between 1972 and 1979, the number and capacity of child care centers was increased by 27 and 89 percent, respectively (see Table 51); child care, though formerly provided for free, was made available on a sliding-scale basis in 1977. Thus, the child care needs of the country are apparently being fulfilled, especially considering that rapid fertility decline will reduce the number of children likely to need these facilities in the future.

Current rates of female employment contrast with the attrition patterns of the early 1970s. Since 1969, the proportion of women in the labor force has increased from 22.9 percent to 28 percent in 1975 and 29 percent in 1979, although the annual definition of the labor force

TABLE 50 Percent of Women Economically Active, Employed, and in the Potential Labor Force, by Age and Marital Status, 1970, 1979: Cuba

Age Group	Economically Active, by Marital Status				All Marital Statuses		
	All Marital Statuses		Married and in Consensual Union, 1979	Single, Separated, Divorced, and Widowed, 1979	Economically Inactive in the Potential Female Labor Force, 1979	Currently Employed in the Labor Force	
	1970	1979				1970	1979
14	1.4	5.2	(3.5)	(11.6)	(5.7)	1.4	3.7
(14-19)		(15.1)			10.8	15.9	11.6
15-19	16.4	17.5	22.9	23.9	10.7	24.7	40.3
20-24	25.3	46.8	34.8	16.7	10.9	23.9	45.4
25-29	24.2	51.5	37.1	13.7	9.7	22.8	46.1
30-34	23.0	50.8	37.6	12.5	8.8	22.0	45.3
35-39	22.1	50.1	33.3	12.2	6.3	21.0	41.6
40-44	21.1	45.5	--	--	--	18.8	33.1
45-49	18.9	35.8	--	--	--	15.9	26.7
50-54	15.9	28.5	--	--	--	12.0	14.7
55-59	12.0	15.3	--	--	--	3.6	4.5
60+	3.6	4.8	--	--	--		

Total	17.8	31.9	39.0	36.6	8.7	17.6	28.1

Note: The economically active population was defined in the 1979 National Demographic Survey as the population age 14 and above of both sexes currently working, those temporarily unemployed currently seeking work, and those seeking employment for the first time. The concept labor force refers to the population employed in the week preceding the survey. The economically inactive were asked if they would be seeking work within the next 6 months. Those indicating they would were classified as future entrants in the potential labor force.

Source: 1970 data and 1979 data on economic activity and labor force for all marital statuses: Comite Estatal de Estadisticas (1981d:Table 5). 1979 data on the potential labor force and 1979 data by marital status: Comite Estatal de Estadisticas (1981b:Tables 13 and 18).

TABLE 51 Trends in Availability and Use of Child Care Facilities, 1972-79: Cuba

Year	Number of Child Care Centers	Year-End Capacity	Number of Mothers Using Child Care Centers	Average Number of Children Enrolled	Average Number of Children Attending[a]
1972	633	42,516	40,837	45,96/	31,870
1973	642	42,172	45,136	51,807	34,630
1974	654	43,581	50,043	54,570	36,633
1975	658	47,147	54,179	59,856	40,361
1976	674	50,463	60,119	64,086	42,312
1977	713	57,788	58,007	65,598	44,957
1978	766	70,639	77,333	72,730	47,267
1979	802	80,509	83,439	88,430	55,398

[a]Defined as the sum of daily attendance figures divided by the number of working days.

Source: JUCEPLAN, C.E.E. (1980:Table 1).

has shifted to include or exclude various ministries or military personnel (see Table 46). Estimates provided by Mesa-Lago (1981) show somewhat lower rates (24 percent in 1978).

Table 47 provides data on the female employed population by economic sector in 1979, based on estimates derived from the 1979 National Demographic Survey. These data show only minor changes from the 1970 distribution of the female labor force. Women's participation in social service occupations (roughly defined as services, education, public health, and other unproductive activities), had increased to one-half of those employed; approximately 18 percent were employed in industry, 13 percent in commerce, and only 12 percent in agriculture and mining. The last two columns of Table 47 demonstrate the employment distribution by sex. Not surprisingly, male workers dominate industry, construction, agriculture and mining, and transportation and communication; women are concentrated in education, culture and art, public health, social security, sports and tourism, and commerce.

Table 48 provides an alternative perspective on female employment, by occupational status. The data show that in 1979, half of the women (in comparison to 19 percent of male workers) were in professional and technical, managerial, and administrative positions. More than one-fourth were involved in service activities, 14

percent were nonagricultural laborers, and 8 percent were agricultural laborers.

Data from the 1979 National Demographic Survey show that 31.9 percent of women aged 14 and above were economically active during the week prior to the survey: 28.1 percent were currently employed, while the remainder were temporarily unemployed and actively seeking employment, or currently seeking employment for the first time. Among women of reproductive age (14-49), 39 percent were economically active; an additional 8.7 percent were classified as in the "potential labor force," that is, expecting to enter the labor force within the next 6 months (Comite Estatal de Estadisticas, 1981b). Although female economic participation in Latin America is frequently underestimated, especially with regard to the enumeration of unpaid family workers, the economic activity rate for Cuba appears to be one of the highest for Latin America, except for Uruguay, but is lower than those for other Caribbean and Central American nations, such as Jamaica, Panama, and Haiti (Safilios-Rothschild, forthcoming). It is lower than the rates estimated for most of the developed Western economies, and much lower (nearly half) than the levels in Eastern European countries with centrally planned economies (International Labour Office, 1977).

Age- and marital-status-specific female economic activity rates for women of childbearing age are shown in Table 50. The overall rates for 1979 are generally above 50 percent for women aged 25-39 and lower at other ages; the rates are considerably lower for women below age 19. Although this is consistent with the pattern of early childbearing in Cuba and the high rates of enrollment in secondary education, it is significant that participation rates below age 25 are also much lower than those found in other socialist countries or in developed Western economies (International Labour Office, 1977).

No data have ever been published on the number of live births or fertility desires of employed and nonemployed women in union. In the absence of any meaningful cross-tabulations on female employment and fertility, controlling for age, marital status, and education, it is impossible to assess the extent to which childbearing is an impediment to work outside the home or vice versa. However, some inferences can be drawn from the available data.

Table 52 illustrates the change in female economic participation among women aged 14 and above by marital

TABLE 52 Percent of Women Aged 14 and Above Economically Active and Inactive, by Marital Status, 1970, 1979: Cuba

Marital Status	Economically Active Female Population			Economically Inactive Female Population[a]	
	1970	1979	Percentage Change 1970-1979	Number	Percent
Single	21.8	25.0	14.7	556,431	24.5
Married	16.3	36.7	125.2	899,274	39.7
Consensual Union	9.2	24.8	170.0	462,181	20.4
Divorced	41.5	63.2	52.3	67,939	3.0
Separated	--	45.3	--	64,582	2.8
Widowed	7.7	9.1	18.2	217,059	9.6
Total[b]	16.9	31.6	87.0	2,267,466	100.0

[a]The economically inactive population includes persons temporarily out of work seeking employment, housewives, students, pensioners and recipients of economic assistance, and other similar situations.
[b]Data exclude women with unknown marital status.

Source: Comite Estatal de Estadisticas (1981d:Tables 6 and 9).

status. As the table indicates, the increase in female employment during the past decade has occurred primarily among married women and women in consensual union, rather than among single women. The proportion of married women employed increased from 16.3 percent in 1970 to 36.7 percent in 1979; among women in consensual union of lower education, an increase from 9.2 percent to 24.8 percent was reported. In contrast, relatively little change occurred in economic participation among single women aged 14 and above, 25 percent of whom were employed in 1979. Approximately 71.9 percent of single women, 55.8 percent of married women, 65.3 percent of women in consensual union, and 57.6 percent of women in other marital statuses were economically inactive and did not intend to enter the labor force at any time during the next 6 months.

Economic participation is also highest following the ages of peak childbearing. Table 50 provides data on the proportion of women in union and not in union who were economically active at the time of the 1979 survey, classified by five-year age groups. These data show that

33 to 38 percent of the women in union aged 25-44 were economically active; participation rates of women in union aged 20-24, and especially those aged 14-19, were much lower. As previously reported, age-specific fertility rates in 1979 ranged from 74.5 births per 1,000 women aged 15-19 to 131.8 births among those aged 20-24, and 80.2 among those aged 25-29. Thereafter, age-specific fertility drops sharply. The data therefore suggest that the majority of new entrants into the labor force began employment following childbearing, and that childbearing and employment still remain relatively incompatible as far as the time constraints involved.

Overall, it can be concluded that increased female education and employment levels, high rates of female participation in mass organizations, and statutory changes have all helped to alter women's traditional roles. In turn, these changes, usually associated with the process of modernization, should contribute to lower fertility through a rise in the female opportunity wage and an increase in the value of foregone female income. Provision of child care facilities on a sliding-scale basis should further encourage female employment by reducing the substitution costs of women's household services. Passage of the Family Code in 1975 and political discussion in mass organizations have also promoted a more egalitarian view of husband-wife relationships, including a sharing of domestic tasks and child-rearing responsibilities. According to some of the provisions of the Code, these tasks are to be shared equally by men and women; similarly, most legal distinctions by sex have been eliminated. Although the actual effect of these statutes on family relations cannot be assessed, in theory, they encourage employment through a reduction in child care constraints. Time-budget data reviewed below, however, still indicate a sharp division of labor on domestic tasks. Finally, policies aimed at maintaining full or nearly full male employment, age restrictions on employment, and compulsory education may also be involved in lower fertility since they have contributed to reducing the economic value of children to parents. However, the relatively low levels of female employment are incompatible with the extremely low fertility levels currently prevailing in Cuba.

It is likely that future incorporation of women into the labor force will slow in pace with the arrival at working age of the large baby boom cohorts. To illustrate, the number of persons aged 15-19 increased 42

percent from an estimated 800,000 persons of both sexes in 1975 to some 1,136,000 in 1980, a dramatic increase following a period of gradual growth. Between 1980 and 1990, the age group 20-29 is projected to increase by more than 700,000 persons, in comparison to the increase of 142,000 between 1970 and 1980 (Comite Estatal de Estadisticas and CELADE, 1980b). Efforts to increase labor productivity and improve economic performance through use of capital-intensive measures, especially in the agricultural sector, should also serve to slow the increase in female employment. The 1981-85 plan reportedly "set as a goal the maintenance of the current proportion of female participation in the labor force" (Mesa-Lago, 1981:20).

Time Constraints

Cubans, particularly working women, face a number of constraints on the time available for childbearing and rearing. These include employment, the performance of domestic tasks, transportation time, leisure, and social and political participation (in mass organizations, volunteer work, guard duty, and meetings and assemblies).

Table 53 illustrates the results of a time use study conducted in April 1975 among 251 employed and 339 non-employed women residing in five Cuban cities (Santiago de Cuba, Camaguey, Matanzas, La Habana, and Nueva Gerona). Respondents were asked to record the approximate number of hours spent on a variety of activities on the day prior to the interview. Unfortunately, data were not collected on the women's fertility (Garcia, 1978). Employed women spent considerably less time during the week on domestic activities (including childrearing), physiological activities, and leisure; as might be expected, they spent more time in transportation, but only a bit more time in political and social activities. The amount of time spent by employed women in domestic activities increased on the weekends (from 3:42 hours to 7:54 hours), but was still less than that recorded for nonemployed women (8:36 hours). Leisure time increased for both groups of women on the weekends. However, for nonemployed women, the increased leisure time was due directly to reduced time spent in domestic and physiological activities; for employed women, increased leisure time resulted from a reduction in work hours.

TABLE 53 Time Budgets for Employed and Nonemployed Women on Weekdays and Weekends, Five Cities, 1975: Cuba

	Average Time Spent (in hours and minutes)			
	Weekday		Weekend	
Activity[a]	Employed Women[b]	Nonemployed Women	Employed Women[b]	Nonemployed Women
Work	8:06	--	--	--
Transportation	1:12	0:30	0:48	0:48
Domestic Tasks	3:42	9:18	7:54	8:36
Psychological Activities	8:42	10:00	9:54	9:36
Political and Social Activities	0:30	0:18	0:24	0:06
Leisure Time	1:36	3:54	5:00	4:36
Unregistered Time	0:12	--	--	0:18
Total	24:00	24:00	24:00	24:00

[a]The activities covered include work, transportation (including commuting), domestic tasks (e.g., cooking, washing, shopping, sewing, ironing, child care, and use of public services), physiological activities (sleeping, eating, personal cleanliness), social and political activities (CDR work, volunteer labor, guard duty, and meetings and assemblies), and leisure time activities (all other time).

[b]Weekday time budgets for employed women pertain to an actual work day; weekend data for these women pertain to a nonwork day. Part of the sample was interviewed with regard to weekday activities and the other half with regard to weekend activities.

Source: Garcia (1978:44-47).

Another time budget study conducted in September 1975, in the five provincial capitals of Pinar del Rio, Matanzas, Santa Clara, Camaguey, and Santiago de Cuba was designed to assess differentials in time use between males and females (Hernandez, 1978). For this study, 1,180 interviews were conducted with 473 employed males, 262 employed females, and 445 nonemployed females aged 16 to 65. The methodology used required self-registration of time on the day following the interview. Table 54, which averages time use from Monday to Sunday, shows differentials between employed and nonemployed women similar to those previously mentioned. Employed women spent less time during the week on domestic, physiological, and leisure activities. Comparisons between men and

TABLE 54 Time Budgets for Employed Men and Women and Nonemployed Women on an Average Day (Monday-Sunday), Five Provincial Capitals, 1975: Cuba

Activity[a]	Average Time Spent (in hours and minutes)[b]		
	Employed Men	Employed Women	Nonemployed Women
Work	6:56	5:32	---
Transportation	1:52	1:22	0:26
Domestic Tasks	0:38	4:44	9:14
Physiological Activities	9:20	8:56	9:42
Political and Social Activities	0:32	0:20	0:19
Leisure Time	4:40	2:59	4:12
Unregistered Time	0:20	0:07	0:07
Total	24:00	24:00	24:00

[a]The activities covered include work, transportation (including commuting), domestic tasks (e.g., cooking, washing, shopping, sewing, ironing, child care, and use of public services), physiological activities (sleeping, eating, personal cleanliness), social and political activities (CDR work, volunteer labor, guard duty, meetings, assemblies), and leisure time activities (all other time).

[b]Each day of the week was covered through proportional distribution.

Source: Hernandez (1978:91).

employed women, on the other hand, show that men spent considerably less time on domestic activities, more on physiological and leisure activities: the amount of daily time recorded for domestic activities per day was approximately 40 minutes for employed men and 4 3/4 hours for employed women (Hernandez, 1978). Time use studies conducted in 1979 demonstrate many of the same trends. The only exception is the amount of time spent on physiological activities, which was roughly similar for all three groups (Instituto Cubano de Investigaciones y Orientacion de la Demanda Interna, 1980).

In conclusion, employed women spend considerably less time on domestic tasks and record less leisure time than do nonemployed women. Whether this is due in part to lower fertility among employed women cannot be ascertained

from the data. However, employed women spend considerably more time on domestic tasks and have less leisure time than do employed men, indicating that the burdens imposed by domestic tasks are not equally shared. Time constraints due to political and social activities are relatively limited and do not differ greatly between employed men and women and nonemployed women.

SOCIAL POLICIES AND PATTERNS

Education

Increased levels of education appear to be important determinants of the fertility decline in Cuba. Illiteracy rates have declined, adult educational levels have been raised, and educational opportunities have been expanded, particularly in rural areas.

In 1970, the Cuban illiteracy rate stood at 13 percent among the population aged 10 and above, or about half the rate recorded in 1953 (24 percent), the year of the previous census. During the intercensal period, urban illiteracy rates were reduced from 12 to 7 percent and rural rates from 42 to 22 percent. As noted in Table 55, rates of illiteracy among those aged 10-49 had reached 4 percent by 1979 (2.3 percent in urban areas and 7.1 percent in rural areas). Although these figures exclude the older population above age 50, they illustrate the decline in illiteracy by age group, especially sharp in rural areas. This recent evidence suggests that the illiteracy rate in Cuba may be comparable to rates recorded in other Latin American countries with well-developed educational systems, such as Costa Rica and Panama, where the estimated rate is below 10 percent.

As noted in Table 56, based on the 1979 National Demographic Survey, 15.5 percent of the women aged 15-49 had 3 years or less of primary education. These levels may be marginal, especially in rural areas, where 26 percent of the women had achieved only this level of education, as compared to 11 percent of the urban women. However, 47 percent had had at least some secondary education (intermediate and university). In comparison, in Costa Rica, Jamaica, and Panama, the proportions of women who have completed at least 1 year of secondary education or higher comprise only 26, 23, and 33 percent, respectively, of the population of ever-married women aged 20-49 (Diaz-Briquets and Perez, 1982).

TABLE 55 Rates of Illiteracy in the Population Aged 10-49, by Sex and Rural-Urban Residence, 1979: Cuba

Age Group	Urban Areas			Rural Areas			Areas Combined		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
10-14	1.1	0.8	1.1	2.2	1.7	2.0	1.7	1.2	1.4
15-19	1.1	0.7	1.1	2.3	1.6	2.0	1.7	1.0	1.4
20-24	1.1	0.9	1.1	3.4	2.8	3.1	2.1	1.6	1.8
25-29	1.6	1.6	1.6	5.1	4.2	4.7	2.8	2.4	2.6
30-34	2.1	2.5	2.1	7.7	9.6	8.6	3.7	4.7	4.2
35-39	3.5	4.3	3.5	11.7	17.1	14.3	5.7	8.2	6.9
40-44	4.3	5.4	4.3	16.2	21.7	18.8	7.5	10.3	8.9
45-49	6.8	7.3	6.8	22.0	26.9	24.3	11.7	13.1	12.4
Total	2.3	2.5	2.3	6.6	7.6	7.1	3.7	4.2	4.0

Source: Comite Estatal de Estadisticas (1981c:Table 21).

TABLE 56 Female Population Aged 15-49 by Educational Attainment and Rural-Urban Residence, 1979: Cuba

Education	Total		Urban		Rural	
	Number (in 1,000s)	Percent	Number (in 1,000s)	Percent	Number (in 1,000s)	Percent
Primary[a]	1251.7	53.3	694.7	43.9	557.0	72.6
0-3	363.9	15.5	168.0	10.6	195.9	25.5
4-5	361.4	15.4	191.3	12.1	170.1	22.2
6	526.4	22.4	335.4	21.2	191.0	24.9
Intermediate 1+ years	1020.1	43.4	813.5	51.5	206.6	26.9
University 1+ years	77.0	3.3	72.9	4.6	4.1	0.5
Total	2348.8	100.0	1581.1	100.0	767.7	100.0

[a]Primary education has been divided into 0-3 years, 4-5 years, and 6 years (primary school completed). Intermediate education lasts 6 years and includes basic secondary and preuniversity, technical and professional, and teacher preparation, sometimes referred to as "normal school."

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 11).

The expansion of post-primary education and the reduction of class and sex barriers to education were promoted during the 1960s through the abolishment of private schools, the incorporation of rural students into urban schools, and the provision of government scholarship aid. The latter, initiated in 1962-63, provides education, food, dress, and lodging to students, although school uniforms are now excluded. In 1979-80, 3 percent of all primary school students, 38 percent of all basic secondary school students, 61 percent of all preuniversity students, and 41 percent of all technical and professional students were receiving scholarships. The total number of scholarships provided was 580,052, the majority of which were directed to middle-level education.[33]

The number of schools and teachers at all levels of education has greatly increased, as have the number of students enrolled and graduated. By 1976, for example, an impressive 99 percent of children aged 6-12 attended primary school. Although children are expected to remain in school until age 16, attendance of children aged 13-16 is lower (78.3 percent of the school-age population in

1975-76) (Hernandez Castellon, 1977). At age 17, males are required by law to seek employment until age 60, unless physically incapacitated. School drop-out rates are reportedly higher for women in rural areas and are probably related to an earlier age at union.

Table 57 summarizes overall educational statistics for selected years between 1960 and 1980. Some discrepancies in enrollment figures exist in published data, as noted in the table, and these statistics should therefore be interpreted cautiously. In part, the increase in enrollment reflects demographic growth associated with the baby boom, as suggested by the figures on enrollment in primary school for 1974-75 and 1979-80. As the baby boom children have aged, the number of students in primary school has declined, and enrollments have increased substantially at higher levels. From 1960-61 to 1979-80, university enrollment increased from 19,454 students (both private and public) to 146,240, in part because of the expansion of primary and intermediate-level education. Younger cohorts have attained higher education levels than older ones since the former have benefited by the recent expansion of education services.

At the university level, reforms have created an educational system more attuned to national needs. Students have been channeled into priority areas such as education, economics, engineering, agriculture, and health sciences. At all levels, education has been made equally accessible to men and women, although ideological and political criteria play a role in determining admission to universities and technical institutions. Only a small proportion of women had received at least some university education in 1979--approximately 3 percent of the women aged 15-49, according to the National Demographic Survey. However, among matriculated students in 1978-79, women constituted 48 to 54 percent at all but the university level, where they constituted 40 percent.

The government has also raised the cultural and educational level of its adult population through a variety of innovative programs begun in 1962, designed to encourage the adult population to attain a sixth-grade education by 1980 and to qualify women for employment. Adult education includes "worker-peasant" education for the recently literate up to sixth grade, secondary courses, language training, and "worker-peasant" pre-university classes. In addition, special courses in both adult education and training have been provided. Adult education programs have been extremely successful. From

1962-63 through 1974-75, 662,023 adults reportedly completed the sixth grade. In 1974-75, 411,980 persons were enrolled in adult education programs; by 1979-80, this figure had decreased to 391,990, suggesting that the need for these programs was declining. In 1979-80, 176,808 adults graduated from these schools.

The Cuban educational system still has a number of problems, including quality of instruction and a high student-teacher ratio (this should improve significantly in the 1980s at the primary school level, but worsen at the secondary level because of the aging of the baby boom cohorts); irregular educational materials; and poor building maintenance (Dominguez, 1978). By 1979, as Table 56 shows, the government goal of 6 years of primary education as a national norm was far from having been attained: 31 percent of the women of reproductive age had not completed primary school. In rural areas, nearly half of all women of childbearing age had completed less than 5 years of primary education. Over half of all women, especially those in urban areas, had reached but not necessarily completed intermediate education; only about one-quarter of rural women had done so.

Educational improvements of the magnitude described above have undoubtedly been important factors in Cuba's fertility decline. A perspective on the extent to which educational attainment and fertility are associated is provided in Tables 58, 59, and 60. As these tables show, age-specific and total fertility rates are much lower among the better-educated than among the least-educated. For instance, in 1965 the total fertility rate of women with 0-3 years of education was 6.3 children, as compared to 2.0 among those with at least 1 year of university education. From 1965 to 1977, the sharpest reductions in fertility occurred among women with less than a primary school education, especially among those with less than 3 years of schooling completed, whose fertility began to decline after 1967. The smallest changes occurred among the better-educated women. Among these women, fertility increased somewhat during the early 1970s and then continued to decline (see Figure 18). After 1972, fertility declined more sharply among these women. By 1977, those with lower intermediate, upper intermediate, and university educations had achieved below-replacement-level fertility (TFRs of 2.0, 1.6, and 1.5, respectively).

Table 59 illustrates the decline in fertility within different educational and age groups from 1964-66 to 1976-78. During the period in question, declines in

TABLE 57 Educational Data, Selected Years, 1960-61 to 1979-80: Cuba

Year	Educational Level						
	Primary	Basic Secondary	Preuniversity	Technical and Professional[a]	Teacher Preparation[b]	University[c]	Adult Education[d]
Teaching Personnel							
1960/1961	29,924[e]	4,055	1,169	1,300	--	1,845[f]	--
1970/1971	60,592	14,334	939	4,692	1,910*	4,415	--
1974/1975	78,451	24,541	1,963	6,173	3,353*	5,847	26,501
1979/1980	77,063	50,815	9,738	15,018	6,078	10,736	29,201
Matriculated Students[g]							
1960/1961	1,136,277	71,057	18,697	25,632	--	19,454[f]	--
1970/1971	1,664,634	171,206	15,461	27,899	58,293*	35,137	--
1974/1975	1,801,191**	307,209	30,315	94,634*	88,137*	68,451	411,980**
1979/1980	1,550,323**	690,503	135,349	214,615	109,905	146,240	391,990
Scholarship Students[h]							
1960/1961	--	--	--	--	--	--	--
1970/1971	58,192	41,519	3,930	22,148	23,574*	18,229	79
1974/1975	46,089	122,559	13,533	60,112*	40,090**	21,566	--
1979/1980	50,769	259,217	82,987	99,901	35,613	41,478	--
Graduated Students[i]							
1960/1961	34,786	10,320	1,486	1,750	--	2,430	--
1970/1971	82,332	7,589	4,227	6,135	2,276*	3,624	--
1974/1975	190,611	27,210	7,810	16,257	10,624*	6,106*	133,505*
1979/1980	263,636	134,384	23,456	49,764	30,651	15,343	176,808

Notes: -- indicates data unavailable. Table includes all education data with the exception of juvenile education designed to elevate educational levels of 13 to 16-year-olds who have not been promoted and special education for students with physical, mental, emotional, or social anomalies.

* Data from previous issues of JUCEPLAN, C.E.E. show smaller totals.
** Data from previous issues of JUCEPLAN, C.E.E. show larger totals.

[a]Technical and professional school prepares students for a profession other than teaching (basic and university education); includes institutes of industry, agriculture, economics and administration, languages, and polytechnics.
[b]Teacher preparation includes all activities related to the formation of teaching personnel. Data for the 1970s include accelerated plans to train teachers in intensive courses, when upon completion they teach and continue studying until they reach the necessary grade level. Data on teacher preparation tend to fluctuate widely in different issues of the Anuario and should be considered highly tentative.
[c]University education is the level achieved upon completion of the minimum requirements of preuniversity training or demonstration of equivalent knowledge; includes faculties of technology, agricultural sciences, sciences, medical sciences, humanities, economics, and pedagogy.
[d]Adult education consists of classes organized for adults, and in some cases adolescents not subject to regular school obligations; includes worker-peasant education (recently literate to sixth grade), secondary course, language school, and worker-peasant faculty (preuniversity); second-semester data only.
[e]Excludes private sector.
[f]Includes private universities.
[g]Matriculated students are those enrolled in school at the beginning of the school year.
[h]Scholarship students receive food, dress, and lodging during the time they remain matriculated. Scholarship aid was initiated in 1962/1963.
[i]Students promoted to last grade or year.

Source: JUCEPLAN, C.E.E. (1976:Tables 7-15; 1979:Tables 7-17).

TABLE 58 Total Fertility Rates, by Educational Attainment, 1965-77: Cuba

Education	Births per 1,000 Women, 15-49												
	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Primary													
0-3 years	6.3	6.4	6.3	6.2	5.9	5.7	5.6	5.4	5.2	4.7	4.3	3.8	3.2
4-5	5.2	5.1	4.9	4.8	4.6	4.6	4.7	4.7	4.4	4.1	3.9	3.8	3.4
6	4.2	4.0	3.8	3.7	3.6	3.6	3.7	3.6	3.4	3.1	3.0	2.8	2.6
Lower Intermediate[a]	3.2	3.1	2.9	2.9	2.9	3.1	3.0	2.9	2.6	2.4	2.3	2.2	2.0
Upper Intermediate	2.7	2.5	2.5	2.5	2.6	2.4	2.5	2.3	2.2	1.8	1.7	1.6	1.6
University 1+ years	2.0	2.0	1.8	1.7	1.6	1.6	1.7	1.8	1.6	1.5	1.4	1.4	1.5

[a]Intermediate schooling of 6 years includes basic secondary, preuniversity, technical and professional school, and normal school for teacher training.

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 12).

TABLE 59 Age-Specific Fertility Rates for Five-Year Age Groups, by Educational Attainment, 1964-66 and 1976-78: Cuba

	Age Group						
Education	15-19	20-24	25-29	30-34	35-39	40-44	45-49
0-3 Primary							
1964-66	217	314	276	224	156	67	16
1976-78	178	204	116	78	47	20	5
4-5 Primary							
1964-66	180	276	241	177	107	48	6
1976-78	--	206	120	68	36	16	2
6 Primary							
1964-66	136	232	199	141	84	36	7
1976-78	--	167	90	51	23	8	2
Lower Intermediate							
1964-66	84	191	163	108	61	29	6
1976-78	78	139	90	49	27	5	3
Upper Intermediate							
1964-66	53	143	158	122	42	18	3
1976-78	27	113	84	48	33	10	2

Note: -- indicates inadequate data for estimation (as in Table 60) of TFR.

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 13).

fertility were especially marked among women aged 25 and above, regardless of educational level, but especially among those with less than a primary school education. By the end of the 1970s, age-specific fertility rates did not differ greatly among women who had at least completed primary school. The smallest declines occurred among those under age 25, except for those 15-19 with the highest levels of educational attainment. Age-specific fertility rates are still higher among women aged 15-19 and 20-24 with less than a primary school education. However, over time, the largest percentage decline in the total fertility rate was recorded among the least-educated women and the smallest among the most educated (Figure 19).

TABLE 60 Total Fertility Rates, by Former Provincial Division and Educational Attainment, 1964-66 and 1976-78: Cuba

	Pinar del Rio		La Habana		Matanzas		Las Villas		Camaguey		Oriente	
Education	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78	1964-66	1976-78
Primary												
0-3	6.1	3.4	5.3	2.2	5.6	2.3	5.7	2.6	5.8	3.4	6.9	3.8
4-5	4.7	3.6	5.1	3.1	4.4	2.9	4.9	3.1	4.5	3.5	5.6	3.6
6	4.3	2.6	4.0	2.3	4.2	2.0	4.0	2.2	4.3	2.9	4.6	2.8
Intermediate 1+ years	3.2	1.7	2.8	1.8	3.0	1.8	2.7	1.8	3.6	1.9	3.5	2.0
University 1+ years	--	--	1.8	1.5	1.5	1.1	1.6	1.4	--	--	--	1.3

Note: -- indicates inadequate data for estimation of TFR.

Source: Comite Estatal de Estadisticas and CELADE (1981:Table 14).

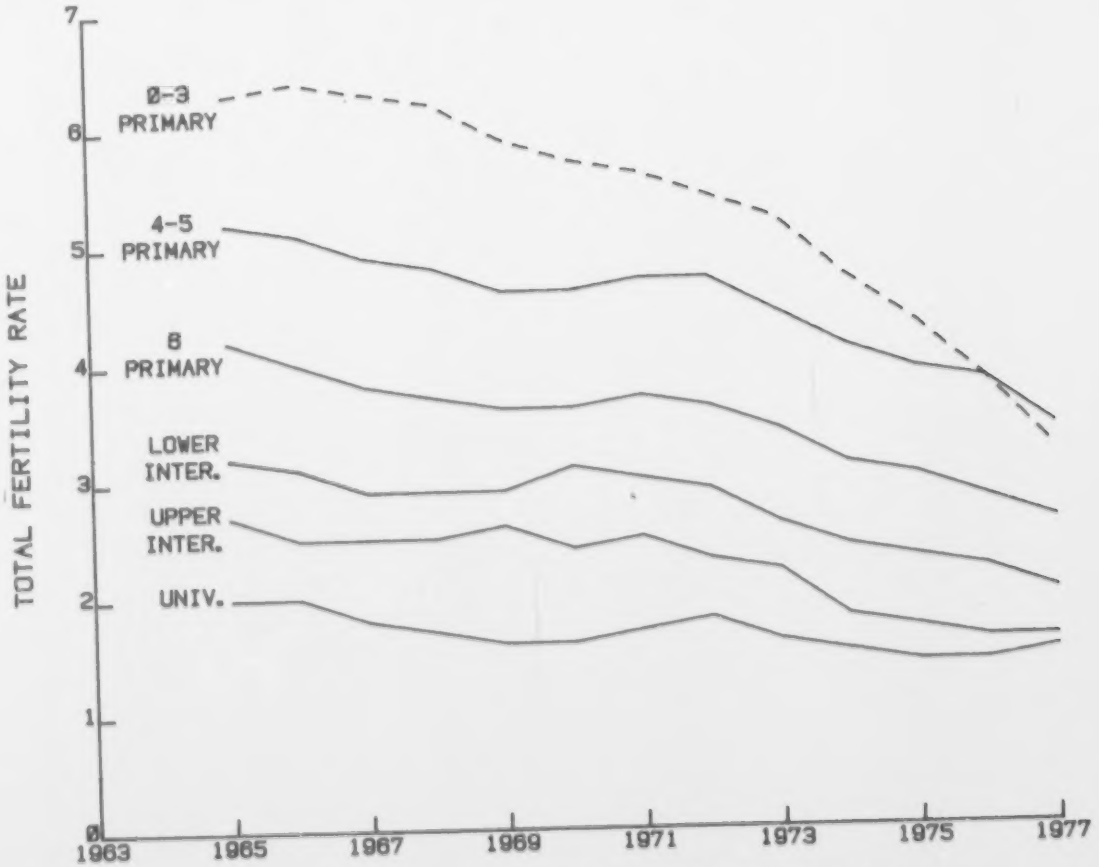

FIGURE 18 Total Fertility Rates, by Educational Attainment, 1965-77: Cuba

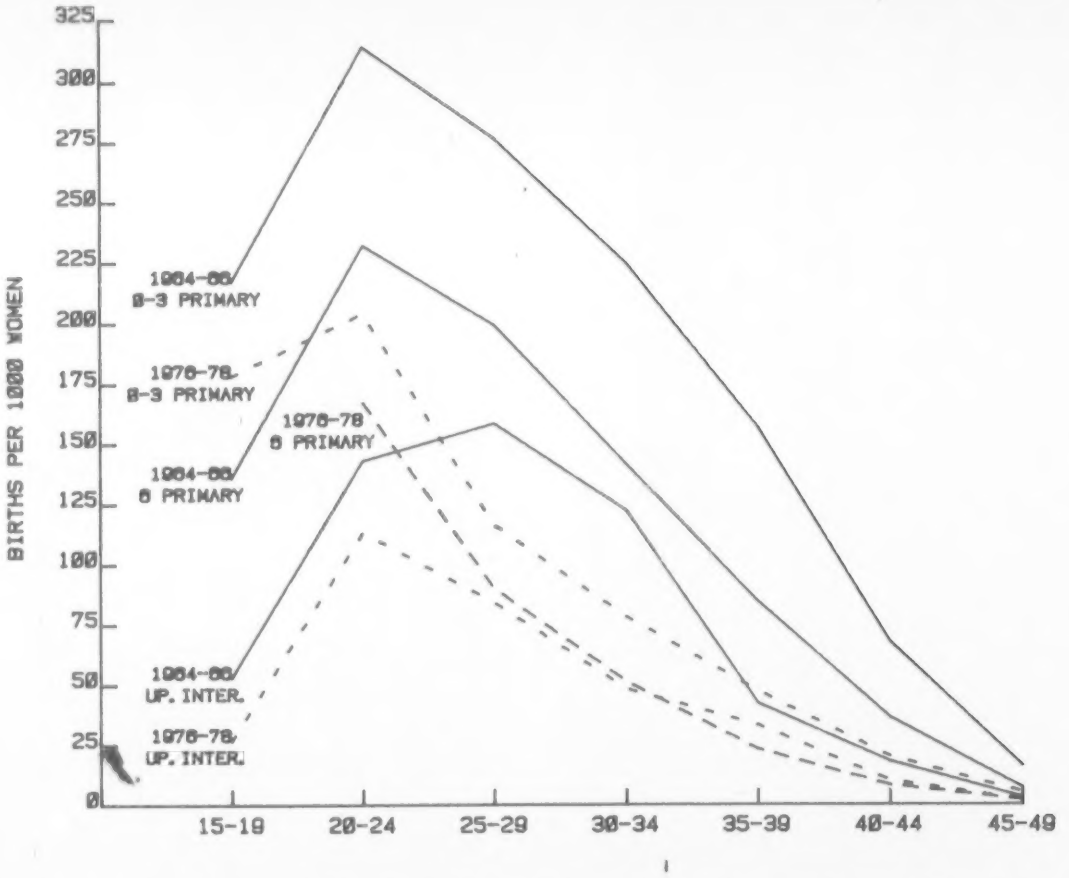

FIGURE 19 Age-Specific Fertility Rates for Five-Year Age Groups, by Educational Attainment, 1964-66 and 1976-78: Cuba

Table 60 shows differentials in total fertility rates by education and provincial division. At the tail-end of the baby boom, fertility among women with 0-3 years of education was high in all provinces, but especially in the rural provinces of Pinar del Rio and Oriente where TFRs of 6.1 and 6.9, respectively, were recorded. By the end of the 1970s, however, fertility had declined in all provinces within all educational categories; women with at least some intermediate education had reached replacement-level fertility. Fertility still remained somewhat higher in Pinar del Rio, Oriente, and Camaguey among women with less than intermediate levels of education (Comite Estatal de Estadisticas and CELADE, 1981).

The role of educational improvements in the fertility decline is difficult to judge. The direct relationship has recently been estimated by consideration of what the overall fertility level in 1978 would have been had the total fertility rates by educational group in 1964-66 been applied to the educational structure recorded in 1978 (Comite Estatal de Estadisticas and CELADE, 1981). By comparing the hypothetical total fertility rate thus derived against the actual rate, it was possible to estimate the "independent" effect of education on fertility. These calculations suggest that roughly 20 percent of the total fertility decline can be directly attributed to educational changes.

Of course, this estimate does not take into account other potential mechanisms through which improvements in educational attainment could have influenced fertility. It should also be noted that the calculations on which the estimate is based tend to overestimate the independent impact of educational changes on the course of fertility decline; this is because the years 1964-66 constitute a historical anomaly, corresponding to the tail-end of the baby boom of the 1960s. As noted earlier, the birth rate had risen from about 26 in 1958 to 35 in 1963-64, or by 35 percent. Thus, the "direct" contribution of increased educational attainment to fertility decline is less than the estimated 20 percent, although an exact calculation cannot be made without data on total fertility rates by educational attainment for the period immediately preceding the revolution.

Delivery of Health Services

Today Cuba has one of the most advanced health care systems in the developing world. The coverage of the

system, emphasizing preventive, primary health care, is nearly universal in both urban and rural areas. In 1961, all major private hospitals were nationalized; by 1963, all health care had become state-administered, and medical services were provided free. Medicines, although sometimes in short supply because of the hemispheric embargo and the necessity of importation from socialist countries, are provided free or sold at highly subsidized prices within national pharmacies.

During the last decade, Cuba has done exceptionally well in improving health conditions. In the last two decades, the allocation of national resources to the health sector has been disproportionate in relation to the country's total resources in view of its economic difficulties. This investment of resources began to pay off in the early 1970s, when the service levels of the late 1950s were finally surpassed. In the interim, new health facilities and personnel have been concentrated in rural areas, resulting in a notable change in regional distribution and hence equalization of medical facilities.

Health care services are organized into three levels: primary, secondary, and tertiary. The primary range of services is concentrated at the local level through the polyclinic, an ambulatory out-patient facility, and its affiliated organizations, such as rural hospitals, medical posts, and maternity homes (Rojas Ochoa, 1976). Each municipality (169 in total) has a defined number of health areas (332 in total)--a geographical district with 20,000 to 30,000 people. These areas are served by an urban polyclinic or rural hospital. In turn, each health area is subdivided into health sectors; the staff of each polyclinic is divided into primary horizontal teams composed of one of the primary care specialists (internist, pediatrician, or obstetrician-gynecologist), a corresponding nurse, and an assigned panel of patients. Thus, a pediatrician-nurse is responsible for the health promotion and maintenance of 2,000 to 3,000 children in a specific geographical area served by the polyclinic; internists are responsible for 3,000 to 5,000 adults; and every obstetrician-gynecologist is responsible for 3,000 to 4,000 women above age 15 (Rojas Ochoa, 1976). By 1981, this health service delivery system, termed "medicine in the community," had been extended to more than 90 percent of the polyclinics in the country. In 1980, the average number of polyclinic consultations was an exceedingly high 12.7 per infant, 3.6 per child aged 1-4, and 1.6 per child aged 5-14 (Ministerio de Salud Publica de Cuba,

1981). Rural hospitals and health facilities are staffed by newly graduated physicians, who must serve a mandatory period of 2 years of rural service, with the backup of more experienced physicians; these newly graduated physicians are assigned to different areas according to need. The secondary-level services provide personnel and services for hospitalizations, less-specialized referrals, and backup consultations. Included are general obstetrical-gynecological, pediatric, and maternal-infant hospitals. Finally, at the tertiary level, are hospitals and medical centers offering the most specialized inpatient care, as well as teaching and research activities. As of 1981, there were 386 polyclinics in Cuba (approximately one per 20,000 to 30,000 population), 151 rural medical posts, and 18 other posts; in addition, there were 256 hospitals (90 general, 78 maternity-infant, 35 other, and 53 rural hospitals), and a teaching polyclinic for each province (Ministerio de Salud Publica de Cuba, 1981).

The growth in facilities has been matched by the resources devoted to training physicians and health personnel. Large numbers of physicians have graduated, especially since 1973, to augment and surpass the supply of trained physicians who emigrated during the 1960s. The number and quality of physicians declined in the early 1960s, with the lowest point reached between 1962 and 1964 (probably one physician per 1,200 to 1,500 inhabitants). By the mid-1970s, the number of physicians completing their training per year was three to four times what it had been in the early and mid-1960s. Between 1959 and 1980, over 15,000 physicians were graduated. The prerevolutionary ratio of physicians to 1,000 population was recouped in 1976; by 1980, Cuba had achieved an exceedingly favorable ratio of one physician for every 707 inhabitants, compared to the 1959 ratio of one per 1,000. By 1980, there was one newly trained pediatrician for every 254 births and one newly trained obstetrician-gynecologist per 4,556 women aged 15-44.[34]

The Decline in Infant Mortality

The contribution of the national health system to the well-being of Cuba's population is reflected in the very favorable indicators of mortality summarized in Table 61. Life expectancy at birth for both sexes combined, which by 1970 had reached 70 years, is estimated to have

TABLE 61 Life Expectancies and Infant Mortality Rates, 1958-80: Cuba

Year	Life Expectancy			Infant Mortality Rate[a]
	Female	Male	Both Sexes	
1958				33.4
1959				34.7
1960[b]	66.0	62.0	64.0	37.3
1961				39.0
1962				41.7
1963				38.1
1964				37.8
1965[b]	68.9	65.4	67.2	37.8
1966				37.2
1967				36.4
1968				38.2
1969				46.7
1970[b]	71.5	68.4	70.0	38.7
1971				36.5
1972				28.7
1973				29.6
1974				29.3
1975				27.5
1976				23.3
1977				25.0
1978				22.3
1979				19.4
1980[c]	74.4*	71.2*	72.8*	19.6[d]

*Projected

Sources:
[a]Infant mortality rates 1958-79: Comite Estatal de Estadisticas and CELADE (1980a:Table 2).
[b]Life expectancies in 1960, 1965, and 1970: Farnos Morejon (1976:Table 7).
[c]Life expectancies in 1980: Comite Estatal de Estadisticas and CELADE (1980a:Table 18).
[d]Infant mortality rate 1980: Ministerio de Salud Publica de Cuba (1981:Table 8).

increased to 72.8 years by 1980 (Comite Estatal de Estadisticas and CELADE, 1980a). This life expectancy is similar to those estimated for Jamaica and Panama (70) and Costa Rica (71.2).

This higher life expectancy is attributable, in part, to the eradication of malaria and poliomyelitis and, to a greater extent, to a sharp reduction in mortality from typhoid fever, diphtheria, tetanus, tuberculosis, acute diarrheal disease, and infectious and parasitic disease. In 1980, the five principal causes of death for all ages combined were cerebrovascular diseases, arterial diseases, malignant tumors, influenza and pneumonia, and accidents (see Table 62). This is the pattern typically found in low-mortality countries.

These gains in life expectancy are associated with considerable declines in infant mortality. By 1981, Cuba's officially reported infant mortality rate stood at 18.5 per 1,000 live births. Although an independent evaluation conducted for this study, based on the 1979 National Demographic Survey, indicates considerably higher infant mortality for the late 1970s than the official figures, the latter are accepted for two reasons. First, there is statistical consistency in the previous mortality estimates, and second, there is no evidence that the official registration system has sharply deteriorated. Therefore, it appears that the survey data are probably distorted and that the official figures should be accepted as broadly accurate. This substantial decline in overall infant mortality is attributable first to a decline in mortality from acute diarrheal disease and infectious and parasitic disease. Between 1966 and 1980, the mortality rate from acute diarrheal disease declined from 20.2 deaths per 100,000 inhabitants to 3.1 deaths; infectious and parasitic disease mortality rates declined from 48.1 deaths per 100,000 inhabitants to 10.1 deaths. The decline in infant mortality is also attributable to the national plan for maternal-infant care, which, as noted above, set goals for the reduction of infant and maternal mortality. As shown in Table 63 and Figure 20, from 1966 to 1980, infant mortality declined 47 percent from 37.3 deaths per 1,000 live births to 19.6 deaths and a provisional rate of 18.5 deaths in 1981. Maternal mortality declined 42 percent from 90.2 deaths per 100,000 live births in 1966 to 52.6 deaths in 1980 and a provisional rate of 40.4 deaths in 1981.

TABLE 62 Cause-Specific Death Rates[a], Selected Years, 1968-80: Cuba

Cause of Death	1968	1970	1972	1973	1974	1975[b]	1976[b]	1977[b]	1978[b]	1979[b]	1980[b]
Heart disease	149.1	148.6	135.4	144.6	155.8	148.3	159.0	162.7	168.9	165.4	167.9
Malignant tumors	96.6	98.9	100.8	99.2	98.8	99.3	104.0	104.4	99.2	102.3	106.8
Cerebrovascular diseases	66.2	60.3	53.0	51.5	52.1	50.8	51.9	57.1	53.6	53.5	54.6
Influenza and pneumonia	40.7	42.1	34.1	37.7	45.6	38.8	41.9	44.6	44.8	41.1	40.1
Accidents	31.9	36.1	31.8	31.7	31.4	33.3	33.5	39.5	38.6	38.0	37.7
Principal neonatal afflictions	41.6	41.7	36.9	32.6	28.7	25.2	20.0	17.9	14.7	14.0	13.3
Suicides and self-inflicted injuries	12.6	11.8	14.3	13.7	17.2	17.2	17.6	17.7	19.0	19.3	21.3
Diabetes	12.6	9.9	10.0	10.0	8.6	10.2	11.1	11.7	11.7	10.1	11.0
Congenital anomalies	15.4	14.1	14.1	13.3	12.5	12.0	10.9	10.0	8.5	8.4	7.9
Bronchitis, emphysema, and asthma	15.3	12.5	11.6	11.5	10.3	8.0	7.6	7.8	7.3	6.8	6.8

[a]Cause-specific death rates per 100,000 mid-year population, all ages.
[b]Provisional rates.

Sources: 1972-74 figures: Ministerio de Salud Publica de Cuba (1978:Table 7). 1968, 1970, 1975-78 figures: Ministerio de Salud Publica de Cuba (1979:Table 6). 1979-80 figures: Ministerio de Salud Publica de Cuba (1981:Table 6).

TABLE 63 Infant and Maternal Mortality Measures, 1966-80: Cuba

Year	Late Fetal Mortality Rate[a]	Mortality Rate (fetal deaths plus 0-7 days)	Early Neonatal Mortality (0-7 days)[b]	Late Neonatal Mortality (7-27 days)[b]	Postneonatal Mortality (28 days to 11 months)[b]	Infant Mortality (less than 1 year)[b]	Mortality (1-4 years)[c]	Maternal Mortality Rate[d]
1966	--	--	21.2	5.5	10.6	37.3	1.7	90.9
1967	--	--	15.4	5.8	15.2	36.4	1.8	90.1
1968	16.8	33.3	16.5	6.2	15.6	38.3	1.7	83.0
1969	15.8	32.7	16.9	8.7	21.1	46.7	1.8	85.0
1970	15.3	33.0	17.7	6.1	15.0	38.8	1.3	70.5
1971[e]	14.8	31.4	16.6	5.8	14.1	36.5	1.0	67.6
1972[e]	14.1	29.7	15.6	3.5	9.6	28.7	1.0	52.0
1973[e]	12.8	28.7	15.9	3.5	10.2	29.6	1.2	55.3
1974[e]	12.9	28.8	15.9	3.0	10.4	29.3	1.2	58.1
1975[e]	11.7	26.5	14.8	2.6	10.1	27.5	1.1	68.4
1976[e]	11.2	23.6	12.4	2.7	8.2	23.3	1.0	47.5
1977[e]	10.9	23.7	12.8	2.6	9.6	25.0	1.1	49.1
1978[e]	10.7	22.9	12.2	2.3	7.8	22.3	1.1	45.2
1979[e]	12.7	23.9	11.2	2.0	6.1	19.4	1.0	51.5
1980[e]	12.7	23.9	11.2	2.0	6.5	19.6	1.0	52.6
Percent Change	-24.4	-28.2	-47.2	-63.3	-38.7	-47.5	-41.2	-42.1

Note: -- indicates data not available.

[a]Fetal defined as 7 months and more of gestation according to fetal death certificates from 1968-72. Fetal defined as 1,000 grams and more for 1973-76. Rate per 1,000 live births.
[b]Per 1,000 live births.
[c]Per 1,000 population.
[d]Per 100,000 live births.
[e]Rates from 1971-80 are considered provisional.

Sources: 1966-67 figures: Ministerio de Salud Publica de Cuba (1978:Tables 4 and 6). 1968-80 figures: Ministerio de Salud Publica de Cuba (1980:Tables 6 and 9).

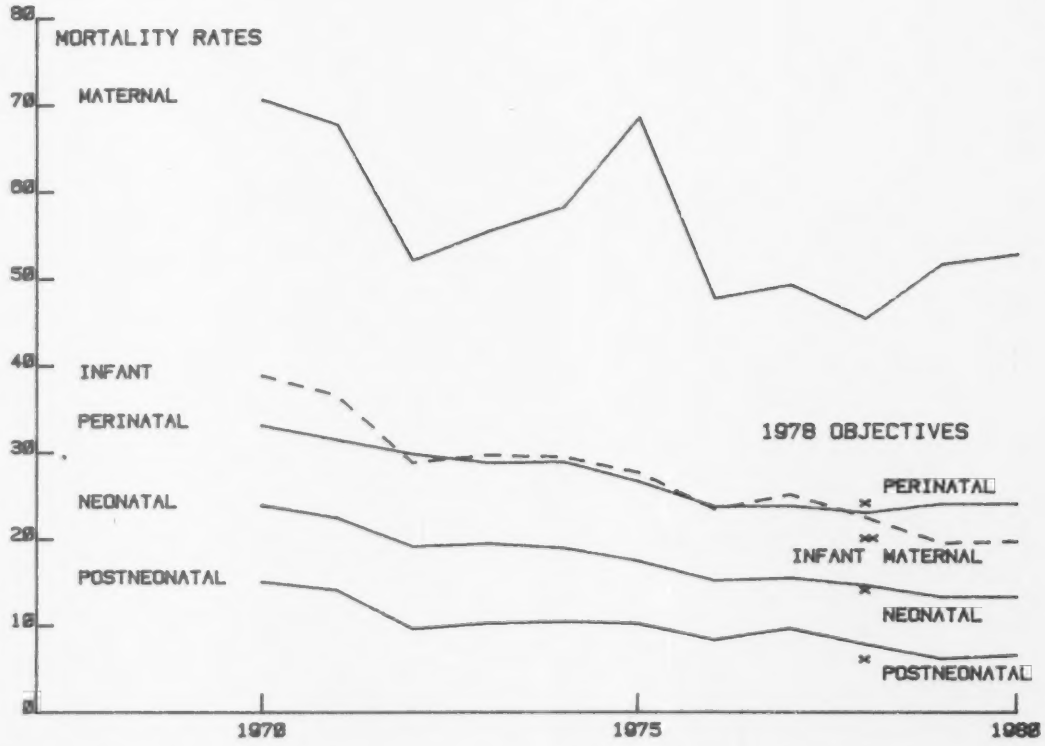

FIGURE 20 Infant and Maternal Mortality Rates and 1978 Objectives, 1970-80: Cuba

Note: Rates per 1,000 live births, except for maternal mortality (per 100,000 live births).

To achieve these goals, government policies have concentrated medical services and personnel in the provinces with the highest infant mortality rates. On the programmatic level, maternal and infant services have been integrated into the national health system: technical norms have been established for obstetrical and pediatric specialties, increasing the number of physicians, specialists, and facilities to ensure better coverage for prenatal, infant, and pediatric care. Early pregnancy detection, institutional deliveries of births, and neonatal services have been developed to treat newborns with low birthweights and various pathologies. Rural maternity homes have also been established, where women living in inaccessible areas or qualifying as high-risk cases can stay during the last few weeks of pregnancy. Finally, priority attention has been given to follow-up of high-risk pregnancies ("dispensarization") among women with hypertension, toxemia, diabetes, and various other pathologies, with special consultations for moderately high-risk pregnancies (smoking mother, Rh negative factor, atypical pregnancy history, etc.).

There are indications that induced abortion has also been used as a therapeutic tool for women with high-risk pregnancies. More recently, efforts have been initiated to reduce the incidence of abortion by increasing the use of modern contraceptives. These policies, greatly facilitated by the high proportion of births delivered in hospitals (77 percent in 1966 to 98.5 percent in 1980), have led to substantial declines in infant and maternal mortality, as shown in Tables 64-67.

The data in Tables 64 and 65 show that infant mortality rates have declined in all regions and provinces in the country, with no pronounced provincial differentials by 1980. The national infant mortality rate was reduced nearly 50 percent between 1970 and 1980. Although infant mortality rates are lower in urban than in rural areas, the differentials tend to be narrow, especially in some regions. For instance, in 1980, infant mortality rates ranged from 14 deaths per 1,000 live births in Matanzas to a high of 24.1 recorded in Guantanamo province. Provincial infant mortality rate differentials, although considerably narrowed, also reflect the same distribution as that previously discussed for fertility differentials. The infant mortality rate was below or near the national average, ranging from 14 to 19.7 infant deaths per 1,000 live births in the provinces of La Habana, Ciudad de la Habana, Matanzas, Villa Clara, Cienfuegos, Sancti

TABLE 64 Infant Mortality Rates, by Former Provincial Division and Rural-Urban Residence, 1973-75: Cuba

Province	Infant Deaths per 1,000 Live Births		
	Urban	Rural	Rural/Urban Ratio
Cuba	26.1	31.1	1.19
Pinar del Rio	23.5	28.4	1.21
La Habana	24.8	27.1	1.09
Matanzas	23.0	24.9	1.08
Las Villas	20.6	21.4	1.04
Camaguey	32.2	43.8	1.36
Oriente	28.9	33.0	1.14

Source: Comite Estatal de Estadisticas and CELADE (1980a:Table 8).

Spiritus, and Holguin; was moderately low at 20.3 to 22.3 in Camaguey, Ciego de Avila, Pinar del Rio, Las Tunas, and Santiago de Cuba; and was somewhat higher at 22.4 to 24.1 in Granma and Guantanamo. The only exception was the small municipality of Isla de la Juventud, which, in 1980, recorded a very low infant mortality rate of 16.2, but relatively high fertility.

The largest remaining infant mortality differentials are by educational attainment of mothers. Rates for women with 3 years or less of primary education are over 40 percent higher than for those with a university education (see Table 66). Similar patterns, though with some minor deviations, can be observed by place of residence and mother's educational attainment in the different regions of the country (Table 67). Table 67, which classifies provinces according to pre-1976 divisions, shows some reversals of the typical rural-urban differentials; an example is Pinar del Rio, where infant mortality was highest among women with completed primary education and surprisingly low, at 19.5, among rural women with incomplete primary education. As noted above,

TABLE 65 Infant Mortality Rates, by Present Provincial Division, 1970-80: Cuba

Province	Infant Deaths per 1,000 Live Births										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980[a]
Cuba	38.7	36.5	28.7	29.6	29.3	27.5	23.3	25.0	22.3	19.4	19.6
Pinar del Rio	33.5	33.2	27.9	29.5	23.8	27.7	25.2	29.4	26.1	20.4	20.5
La Habana	36.9	31.9	29.2	26.7	33.6	30.1	22.6	19.1	18.0	19.0	15.6
Ciudad de la Habana	39.5	25.7	24.3	22.2	24.8	24.8	20.2	21.7	17.7	16.2	17.4
Matanzas	38.7	34.8	23.4	24.3	24.8	22.6	21.2	22.8	19.6	14.9	14.0
Villa Clara	34.9	29.6	21.7	22.5	18.7	17.8	17.2	17.2	16.8	15.6	18.2
Cienfuegos	38.1	35.2	24.3	21.8	24.1	20.5	17.1	18.4	20.9	17.3	18.1
Sancti Spiritus	35.8	38.2	27.4	23.5	24.6	21.3	18.2	18.2	23.0	20.5	18.8
Ciego de Avila	40.3	43.5	27.1	36.0	41.0	32.6	26.4	23.4	17.2	20.2	21.0
Camaguey	43.1	47.6	35.8	37.2	41.0	34.9	26.5	27.4	23.2	18.3	22.3
Las Tunas	36.5	50.3	37.2	29.7	31.3	34.5	25.7	28.5	22.3	26.1	21.5
Holguin	38.3	45.1	30.7	34.3	34.6	33.0	29.0	31.0	30.9	18.3	19.7
Granma	45.7	41.0	35.1	38.8	33.4	26.9	24.7	29.3	26.1	23.9	22.4
Santiago de Cuba	36.3	32.7	26.6	32.0	28.5	28.1	23.6	29.1	23.4	19.5	20.3
Guantanamo	41.8	44.4	36.6	35.3	30.0	26.1	23.7	24.4	24.1	24.1	24.1
Municipality Isla de la Juventud	51.1	45.5	54.6	30.0	46.5	28.0	21.0	21.8	25.9	14.7	16.2

[a]Provisional.

Sources: 1970-79 figures: Comite Estatal de Estadisticas and CELADE (1980a:Table 7). 1980 figures: Ministerio de Salud Publica de Cuba (1981:Table 8).

TABLE 66 Infant Mortality Estimates, by Educational Attainment of Mother and Rural-Urban Residence, 1974: Cuba

		Mother's Educational Attainment				
		Primary (years completed)				
Region	Total	0-3	4-5	6	Intermediate	University
Total	28.4	35.0	30.0	26.1	24.3	20.5
Urban	26.1	35.9	33.0	25.4	23.5	20.1
Rural	31.1[a]	34.1	28.1	26.6	27.6	--

[a]Estimate based on data from the vital register; others from survey data.

Source: Comite Estatal de Estadisticas and CELADE (1980a:Table 11).

estimates based on the 1979 National Demographic Survey do not corroborate the official infant mortality statistics for reasons that are unclear (see Appendix 2). Some of the deviations from expected differentials may be associated with estimation biases related to sample size or a possible misreporting of abortions as dead children; others may simply reflect concerted medical efforts to reduce infant mortality among certain sectors of the population.

In sum, the Cuban health system provides almost universal coverage to all Cubans regardless of social class or place of residence. As a result, the country has achieved health and mortality standards comparable to those found in the more economically advanced countries. Life expectancy at birth exceeds 70 years; infant mortality is only somewhat higher than in developed countries and much lower than in most developing nations. The cause-of-death structure of mortality is dominated by degenerative diseases because mortality from infectious causes has been sharply reduced. Infant mortality has declined rapidly since 1972, reflecting a variety of factors: the gradual recovery in numbers of trained physicians; the impact of the maternal and infant care program; hospital deliveries; declines in mortality from acute diarrheal

TABLE 69 Estimated Deficit of Adequate Housing (in 1,000s of units), 1970-85: Cuba

	1970	1971-75	1976-80	1981-85
Housing deficit in 1970 according to estimates based on census data	1,045[a]			
Estimated number of housing units that need to be replaced during five-year period because of deterioration		230	172	81
(yearly average)		(46)	(34)	(16)
Estimated number of housing units required during five-year period to accommodate demographic growth		162	186	200
(yearly average)		(32)	(37)	(40)
Yearly average number of housing units required to replace deteriorated units and to accommodate demographic growth		(78)	(71)	(56)
Cumulated housing deficit at the end of each five-year period		1,437	1,715	1,914
Housing units built in each five-year period[b]		80	82	
(yearly average)		(16)	(15.4)	
Net deficit at the end of each five-year period		1,357	1,633	
Absolute increment in housing deficit during each five-year period		312	276	
(yearly average)		(62)	(55)	
Net deficit at the end of 1980 after rough adjustments for emigration, housing built under private initiative, and slower population growth[c]				1,500

[a]As of December 31, 1970.
[b]Official data.
[c]Rounded to 1.5 million units from the actual resultant figure of 1.63 million units.

Sources: Data from the 1970 Cuban Census of Population and Housing and estimates: JUCEPLAN (1976:54-63). Data on official housing construction: Mesa-Lago (1981:Table 46).

and infectious and parasitic diseases, related to improvement in sanitation and earlier detection and medical treatment; and the rapid decline in national fertility promoted through use of abortion and contraception. This rapid decline in infant mortality should improve individual perceptions of higher child survival and reduce the demand for surviving children.

Housing

One of the factors associated with Cuba's fertility decline, especially in urban areas, is a housing shortage. Couples may have to postpone marriage because they cannot establish a separate household or delay or limit childbearing because they have inadequate housing space.

Cuba's housing problem is longstanding, characterizing both the pre- and postrevolutionary eras. According to the 1953 census, over 40 percent of the housing was classified as "fair" and 15 percent as "bad." Three-quarters of the rural population resided in poor-quality housing, in comparison to 30 percent of the urban population (Gonzalez et al., 1978). According to different estimates, the deficit of "adequate" housing by the late 1950s amounted to somewhere between 250,000 and 700,000 units, 655,000 being the figure most often quoted (Acosta and Hardoy, 1973; Mesa-Lago, 1981; Roca, 1980b).

Two decades later, the housing situation had worsened considerably for a number of reasons. First, the government had allocated a considerable amount of national construction and labor resources to productive sectors (roads, port and agricultural facilities, factories) and service sectors (schools, health facilities) rather than to housing. Economic inefficiencies and various material shortages also contributed to the low rate of housing construction. Deterioration of the existing housing stock, especially in urban areas, was an additional factor. In depicting the situation in Havana, Roca (1980b:72) writes as follows:

> In 1978, the administrator of the city of Havana estimated that 250,000 dwelling units (50 percent of the total) were in need of repair and that, of these, 30,000 were propped-up by beams and 40,000 were declared uninhabitable.

The effect of Cuba's demographic patterns on the housing shortage is complex. On the one hand, the country has lost over 800,000 people through emigration. The housing abandoned by these emigrants has been expropriated by the government and in most cases distributed to those in need by local CDRs and work centers. Thus, emigration has helped to ease the housing shortage. On the other hand, since the children born in the baby boom of the early 1960s are now approaching adulthood and will soon be forming their own reproductive units, it can be anticipated that they will make the present housing deficit even more acute.

Government figures in Table 68 show a total of 85,447 housing units constructed between 1959 and 1963 (26,050

TABLE 68 Housing Construction, 1959-80: Cuba

Year	Housing Units Built
1959-63	85,447
1964	14,200
1965	5,040
1966	6,271
1967	10,257
1968	6,458
1969	4,817
1970	4,004
1971	5,014
1972	16,807
1973	20,710
1974	18,552
1975	18,602
1976	15,127
1977	20,024
1978	17,012
1979	14,498
1980 (Goal)	15,000
1959-80	297,840

Sources: Roca (1980b:Table 1); Mesa-Lago (1981:Table 46).

in the rural areas). Construction of new housing decreased to about 56,000 units from 1964 to 1971. Units constructed during this period were concentrated in the less developed rural provinces of Pinar del Rio and Oriente, as well as in urban La Habana. Housing construction has accelerated since 1972, averaging approximately 17,700 units per year from 1972 to 1979, for a total of 141,000 units.

As part of the effort to redistribute income, all properties have been nationalized, and tenants pay reduced rents to the state, corresponding to no more than 10 percent of monthly wages. Newly available housing is allocated primarily on the basis of need and worker productivity. Until 1978, apartment units were equipped for free with television, furniture, gas range, and refrigerator. By 1979, the cost of furnishing units was met by payment through credit.

Table 69 provides a gross summary of the housing shortage in Cuba during the 1970s as derived from Cuban estimates and data on annual housing construction, shown in Table 68. The table shows official estimates of housing needs throughout the period 1970-85, based on 1970 census data on housing and a series of official assumptions regarding the useful life of dwellings, projected population growth rates, and average household and dwelling size. To err on the conservative side, the figures shown refer to the one set of assumptions that projects lower housing needs. These projections were adjusted by subtracting the official number of housing units constructed by the state during each five-year period. The figures exclude minor private housing construction efforts, largely limited to rural areas (upgrading of traditional housing of substandard quality), as well as subdivision of existing units, but include housing made available through emigration.

Table 69 indicates that during the 1971-75 period, the deficit in adequate housing rose by approximately 62,000 units per year, and during the 1976-80 period, by approximately 55,000 units a year. Based on the data in Tables 68 and 69, it can be concluded that during the 1970s, the housing deficit increased by nearly half a million units, reaching approximately 1.5 million units by 1980. This latter figure allows for the construction of an unspecified number of private-sector housing units, upgrading of previously inadequate units, rough adjustments for emigration (approximately 220,000 persons during the 1970s), and the sharp decline in the rate of population

TABLE 67 Infant Mortality Estimates, by Educational Attainment of Mother, Former Provincial Division, and Rural-Urban Residence, 1974: Cuba

Province	Mother's Educational Attainment		
	Primary Incomplete	Primary Complete	Intermediate and University
Pinar del Rio			
Total	23.0	34.5	26.0
Urban	30.2	31.1	23.5
Rural	19.5	34.8	31.3
La Habana			
Total	28.9	20.6	23.0
Urban	22.7	21.2	22.7
Rural	--	--	--
Matanzas			
Total	34.3	26.5	13.4
Urban	--	--	12.5
Rural	25.3	25.4	18.7
Las Villas			
Total	24.7	21.0	19.4
Urban	19.1	22.6	13.2
Rural	28.0	18.8	20.4
Camaguey			
Total	37.8	36.2	32.0
Urban	35.3	39.3	31.0
Rural	40.2	31.0	27.6
Oriente			
Total	34.7	27.5	27.7
Urban	40.0	25.6	26.8
Rural	32.4	28.5	30.0

Note: -- indicates sample size too small for estimating rate.

Source: Comite Estatal de Estadisticas and CELADE (1980a:Table 14).

growth since 1973. However, even with the necessary adjustments, the figure amounts to an increase in the housing deficit during the 1970s of approximately 50 percent. As the baby boom cohort continues to enter the marital age groups during the 1980s, the demand for housing will continue to increase.

Recent national data pertaining to the late 1970s indicate that among Cuba's total population of 9,272,211, approximately 5,929,644 lived in houses, 1,238,323 in apartments, 1,697,740 in bohios (traditional rural housing constructed of palm bark or palm leaf), 381,103 in rooming houses, and 25,401 in other types of housing (Comite Estatal de Estadisticas, 1981c). With no assumptions made about the quality of housing, over 2 million people, or a minimum of 22 percent of the population, could be classified as living in substandard housing in bohios or rooming houses.

The last decade has witnessed improvement in rural housing standards. One aspect of the rural housing program has been "micro-urbanization," the resettlement of dispersed rural populations in modern, well-equipped centers of some 250 families each, located near a factory, rural cooperative, or cattle farm. These settlements consist of multi-storied apartment buildings with running water, sewage disposal, and electricity, plus schools and health clinics. By 1979, 353 rural communities of various sizes had been constructed, housing approximately 150,000 people, or 5 percent of the total rural population. An indeterminant number of rural dwellings have also been upgraded through the provision of cement or wooden floors and latrines, resulting in considerably improved sanitation and a reduction in infant mortality (Anonymous, 1973). Electrification has also been extended to many rural areas of the country, especially during the 1970s. The provision of other modern facilities, such as running water, has increased in rural areas, but to a more limited extent.

Although improvements in housing have been made, especially in rural areas, on balance the housing situation has worsened because of population growth, low housing construction rates, and deterioration of the existing housing stock. There are two important implications of this housing situation for Cuba's fertility decline. First, results of small-scale surveys indicate that the urban housing shortage has the effect of postponing marriage, encouraging divorce, and limiting family size. For instance, a small survey conducted in

1970 among 69 divorced couples in Havana found that virtually all couples preferred to live by themselves, but two-thirds had lived with relatives because of the housing shortage (Hernandez et al., 1973). Increased two-generational living arrangements have delayed childbearing for some couples, as implied by a variety of small-scale surveys. Two surveys of women receiving abortions in a Havana hospital and polyclinic suggest that overcrowded housing conditions may be a factor in the decision to terminate an unplanned pregnancy. Although 43 percent of the women had never had a live birth, the majority of 100 women requesting abortion during a 2-month period in 1979 at the Hospital Eusebio Hernandez reported living in extended families with at least five persons in the household, higher than the national average household size of 4.5 and that of Ciudad de la Habana, 3.9. In the Policlinico Parraga survey, among a decidedly small sample of 43 women who had previously requested termination of pregnancy, the majority reported two or more persons per bedroom (Gonzalez Perez, n.d.). Data gathered on a small sample of males, discussed above, indicate that the housing shortage was the principle reason for postponing marriage among the single men and a major reason for limiting family size in the near future among the married men (Gonzalez Perez, 1981). All of these studies are exploratory and permit limited generalization. However, the rise in marriage rates during periods of emigration also suggests that, at least in urban areas, the scarcity of housing delays marriage or limits family size until the existing stock can be redistributed.

A second implication of Cuba's housing situation for fertility decline is that increased "urbanization" of the rural population has probably not been a major contributor to fertility decline, given the relatively small number of rural inhabitants who have been resettled. The majority of the agricultural labor force still lives in dispersed housing rather than within these centers. However, improvements in rural sanitation and the provision of utilities, in conjunction with the maternal and infant care program, may be indirectly associated with rural fertility decline through a reduction in infant mortality.

NOTES

1 Racially, the country's present population descends primarily from European, mainly Spanish, and African stock. As of 1953, 73 percent of the Cuban population was classified as white, 12.4 percent as black, and 14.5 percent as mestizo; less than 1 percent (0.32 percent) was of Asian descent (Republica de Cuba, 1955). Over the centuries, there has been a considerable intermingling of the races, and the proportion of Cubans of mixed racial composition is high. The weight of the native Indian population is very limited; the original inhabitants of Cuba--primarily Taino and Ciboney Indians, estimated at approximately 100,000 in the early 1500s, either perished or were gradually assimilated by the new immigrant groups centuries ago.

2 Despite the primarily agricultural character of its economy, Cuba has traditionally been a highly urbanized country. By 1931, over 50 percent of the country's population was urban; by 1981, seven of every ten Cubans lived in urban localities. The area of metropolitan Havana, seat of the country's capital, has accounted for between 20 and 21 percent of the national population since the 1950s, although in recent years, Havana's growth rate has declined and become comparable to that of the country overall.

3 As noted in Table 4, Cuba's population density per square kilometer increased dramatically between 1899 and 1981. With 87 persons per square kilometer in 1981, Cuba has one of the highest population densities among Latin American countries. However, in comparison with that of other heavily settled Caribbean and Central American countries (e.g., Dominican Republic, Haiti, and El Salvador), Cuba's density is significantly lower.

4 This is defined as the average number of female children a woman would have if she survived to the end of her childbearing years and, if throughout, she were subject to a given set of age-specific fertility rates and a given sex ratio at birth. This number provides a measure of replacement fertility in the absence of mortality.

5 Fertility levels have been consistently highest in the province of Oriente, where the proportions of blacks and mestizos were the highest according to the 1953 census (14.6 percent of the total provincial population was black and 26.2 percent mestizo). However, the relationship is not clear since the effect of race on fertility cannot be assessed independently of many other socioeconomic variables, such as education, income, or occupation. Moreover, no direct assessment can be made for the postrevolutionary period; the Cuban government does not release tabulations of social statistics by race, although data on race were collected in the 1970 census.

6 The estimates derived through use of the own-children technique are based on the work conducted by Hugo Behm Rosas of CELADE-Costa Rica and Juan Carlos Alfonso Fraga of the Direccion de Demografia of the Comite Estatal de Estadisticas (CEE), with the assistance of Oscar Ramos Pinol of CEE and Domingo A. Primante of CELADE-Costa Rica (see Comite Estatal de Estadisticas and CELADE, 1981).

7 The intent of the question on additional children desired was to ascertain the number women would like to have by the end of their reproductive life. However, instructions to the interviewers indicated that the questions should pertain not to an ideal number of children, but to the number desired in the near future, which could be conditioned by study, employment, family relations, or housing conditions. Thus, some women may have interpreted the question as related to spacing desires (additional number desired in the immediate future), rather than to completed desired family size.

8 Women for whom no response was recorded on the number of live births (9 percent) or surviving births (11.5 percent) were placed in the zero-children category, rather than being eliminated from the sample. Since the original sample also included single, divorced, separated, and widowed women, it is not clear what proportion of the "no response" category consisted of

women in union. Among women of reproductive age (14-49) the total proportions childless were 11.3 percent among married women and 9.8 percent among those in consensual union. Among single women, the proportion childless was 97.6 percent; among women of other marital statuses, this proportion was 12.7 percent.

9 While low fertility desires are to be expected given Cuba's current low fertility level, it is not clear whether women would actually prefer to have greater numbers of children. Questions on ideal family size were not included in the 1979 National Demographic Survey, and although such data were gathered in the early community fertility surveys of the 1970s, they have not been published.

10 As part of the Family Code legislation enacted in 1975, the legal age at marriage in Cuba was established as 18 for both men and women. Under exceptional circumstances and for justified reasons, parents, other relatives, or the regional people's court can grant permission for those younger than 18 to formalize their marriage, as long as the woman is at least 14 and the man at least 16 (Ministry of Justice, 1975). Originally, the lower limit for female age at marriage was set at 12; however, when voting on the proposed statute among the local constituencies of poder popular (popular power) demonstrated opposition by a minority of elected candidates, this age was raised to 14.

11 No data are available on the proportion of legal marriages preceded by cohabitation. Data analyzing marital status by race and education have also not been published, although the 1970 census gathered information on both.

12 Slight differences also existed in the census procedure used to ascertain marital status in 1953 and 1970: in 1970, couples were classified as living in consensual union if one partner residing in the same household declared this marital status, regardless of what the other declared; this approach was not taken in the 1953 census.

13 The survey data pertain only to marital status at the time of the survey. Data on the number of previous unions, the date of onset and termination of each, the type of union (legal or consensual), reason for termination (divorce, widowhood, legalization of consensual union), or number of births within each union were not collected.

14 According to the 1975 Family Code, at the time of divorce, joint properties are divided. However, alimony lasts a relatively short period of time. If one party is not employed and lacks other means of support, temporary alimony is paid by the other party for 6 months if there are no children in his or her care and guardianship, or for 1 year if there are, so the beneficiary can obtain employment. If one party is unable to work because of age, disability, illness, or similar impediments, alimony will continue as long as that impediment exists.

Patria potestas (parental rights) is usually granted to both parents, although it can be granted to only one or neither if this is in the interest of the children. Guardianship and care of the child is vested in one parent. Support of the children is a duty of both parents even if they do not have patria potestas or guardianship and care, or if the children are enrolled in an educational institution. In accordance with this rule, the court's decree of divorce sets the amount of child support to be paid by the nonguardian parent, determined by the childrens' normal expenses and the income of the parents (Ministry of Justice, 1975).

15 The medium estimate assumes that the crude birth rate of 17.0 in 1975-80 increases to 18.2 after 1985 and declines to 17.1 by 1995-2000. The crude death rate of 6.0 for 1975-80 increases slightly to 7.2 in 1995-2000 because of the aging of the population.

16 Data on the U.S. Cuban-born population and U.S.-born population of Cuban parentage show an increase from about 5,300 in 1870 to about 15,100 in 1910 and 18,500 in 1930. Following World War II, substantial immigration occurred, and the number of Cuban-born persons residing in the United States increased from about 18,000 in 1940 to 79,200 in 1960. By 1960, the number of first-generation U.S.-born persons of Cuban parentage had increased to about 45,300. By 1970, because of postrevolutionary emigration, the U.S. Cuban-born population had increased to 439,000, while the U.S.-born Cuban population (including an unknown number of second and subsequent generations) had risen to 122,000. Altogether, approximately 561,000 Cubans and their descendants were living in the United States in 1970 and about 700,000 by the late 1970s (Jaffe et al., 1980).

17 Isla de la Juventud was excluded from the calculation of correlation coefficients because of the concentration of educational facilities on the island. These correlations are only suggestive since it is not possible to obtain more refined nuptiality measures, given the high prevalence of consensual unions, excluded from the nuptiality measures and the legalizations of consensual unions that are included.

18 The data on breastfeeding are retrospective and therefore subject to response and rounding error. They were gathered in interviews with the children's mother or primary caretaker and conducted by pediatric social workers as part of the regular postpartum pediatric consultation. If the respondent missed the scheduled appointment, nursing personnel or health workers visited the residence to complete the interview. The survey was conducted in October 1973 when the infants were 7 months old.

19 A surprisingly high proportion of the women, especially those with no or little education, were not following the suggested norms of food supplementation developed by the Ministry of Public Health. They tended to supplement infant diets with carbohydrates rather than foods high in protein, reflecting cultural preferences rather than the influence of food prices.

20 The extension program originally planned for 1979-82 has been rephased to carry the project to 1985. UNFPA allocations for the 1982-85 period amount to nearly $2,967,670 (UNFPA, 1982a).

21 The first survey, conducted in 1971, involved 1,545 women residing in the region of Plaza de la Revolucion, one of six regions comprising the metropolitan area of Havana, province of La Habana. A second survey, in 1973, was conducted of 995 women in the city of Santa Clara, capital of the central province of Las Villas. Third, a census of 3,826 women was taken in the municipality of Yateras, a completely rural, mountainous municipality in the province of Oriente, which was the province of highest fertility in 1973. The fourth and fifth studies, conducted in the region of Marianao and the city of Bauta, on the periphery of Havana, interviewed 2,549 and 1,545 women, respectively. All samples were probability samples of women in their reproductive years, 15-49, with the exception of the Yateras study, which was a census of all women of reproductive

age. The 1980 survey was conducted in Arroyo Naranjo, an area with semi-rural characteristics at the edge of the city of Havana, with a sample of 732 women in union aged 15-44.

22 Approximately 13.5 percent of the women surveyed in Arroyo Naranjo reported that they had experienced an unplanned pregnancy while using contraception. Two-thirds of these women associated their contraceptive failure with the use of traditional methods (jelly, douche, condom, rhythm, and withdrawal); approximately 10 percent reported using the pill, 18 percent the IUD, and 6 percent an unknown method at the time of pregnancy.

23 National data on the incidence of abortion prior to 1968 have not been tabulated. Although the conditions allowing abortion were liberalized in late 1964, educational efforts were initially directed to high-parity women. Access to abortion during these years was dependent upon the disposition of the director of the institution; access to physicians was reduced because of emigration; and clandestine abortion continued. Therefore, the data provided in Table 38 for 1968-69 probably underestimate the actual incidence of abortion.

24 One recent small-scale hospital investigation concluded that 56 percent of "other abortions" involved incomplete spontaneous and incomplete provoked abortions, and the other 44 percent involved therapeutic curettage (Librada Morales, in UNFPA, 1982b); this indicates that induced abortions still occur outside the health system.

25 Anesthetic or septic shock, sepsis, and heart failure were the main causes of the 1980 abortion-related deaths. Five of the eight deaths occurred among women aged 15-24, in contrast to the age distribution of women at time of death recorded for previous years (1968-78), during which only one legal abortion death in eleven was recorded for this age group. No pattern is discernible in the provincial distribution or hospital location of deaths. One possible, but unsubstantiated, explanation is that only deaths associated with legal abortion, initiated within the public health system, were previously classified as legal abortion deaths; other abortion-related deaths (incomplete abortions initiated outside the health system) may have been classified as total abortion deaths rather than legal abortion deaths. A recent

evaluation concluded that the use of surgical curettage, which also requires anesthesia, may be implicated; the evaluation recommended the use of suction curettage and the establishment of written procedures and norms for pregnancy termination, in addition to the eligibility criteria currently specified in guidelines (UNFPA, 1982a, 1982b).

26 In 1976, abortions conducted in Ciudad de la Habana represented one-quarter of all abortions conducted in the country, rising to 26 percent in 1977 and stabilizing at 29-30 percent in 1978-80 (Direccion Provincial de Estadisticas, Ciudad de la Habana, n.d.). According to the results of the 1979 National Demographic Survey, 22 percent of the female population aged 15-49 resided in Ciudad de la Habana.

27 The Agrarian Reform Law of May 1959 set a maximum of 30 caballerias (1 caballeria = 13.4 hectares or 33.1 acres) for farms, except for "range land and farms that were 50 percent more productive than the national average; these could be as large as one hundred caballerias. Foreign and sugar-mill ownership of land was prohibited, as were tenancy, sharecropping, and similar arrangements. Former tenants, sharecroppers, and squatters would get two caballerias of the land they had tilled free; the owners could then be compelled to sell them three more caballerias, for a total of five. The remaining land would be given, in order, to peasants who had been evicted in years past, peasants who had less than two caballerias of land, agricultural workers from the region, peasants being resettled, and agricultural workers being resettled. . . . Compensation for expropriated land, to be paid in bonds over twenty years at 4.5-percent interest, was never paid" (Dominguez, 1978:438).

28 It should be noted that Cuba has been a heavy recipient of Soviet aid during the last two decades. Without this assistance, its economic performance would have been decidedly poorer. Between 1961 and 1979, Soviet economic assistance to Cuba, exclusive of military aid, amounted to an estimated $17 billion (Blasier, 1979; National Foreign Assessment Center, 1981). Even in 1978, a relatively prosperous year, Soviet assistance accounted for between one-fourth and one-third of Cuba's gross national product (Recarte, 1980; Theriot and Matheson, 1979). By

early September 1982, Cuba had begun negotiations with Western banks to reschedule the payment of its foreign debt (in excess of $3 billion), since it was unable to meet the original conditions under which the loans were made.

29 Consumer durables normally available through the parallel system were also used as material incentives to increase worker productivity during the early 1970s. For instance, televisions and refrigerators were awarded to highly productive workers through labor assemblies and party and union recommendations. State-constructed housing and furnished homes left by emigres have also been distributed by neighborhood Committees for the Defense of the Revolution (CDRs) to those demonstrating need and productivity (Dominguez, 1978).

30 Exchange rates are artifically set by the Cuban government. The peso has been tied to the ruble, whose exchange rate is set by the Soviet government. Parallel with the gradual devaluation of the dollar, particularly in 1971 and 1973, the value of both the ruble and peso was raised. In 1978, the official exchange rate was set at $1.31 U.S. for one Cuban peso (Mesa-Lago, 1981).

31 This estimate of unemployment is based on figures for the economically active population minus figures for the population in the labor force. The economically active population was defined in the 1979 National Demographic Survey as those aged 14 and above of both sexes currently working, those temporarily unemployed and currently seeking work, and those seeking employment for the first time. The concept of labor force refers to the population employed in the week preceding the survey. These estimates are based on a sample survey of 4 percent of all Cuban households. The 1953 census utilized two distinct definitions to identify employed persons: the concept of the labor force, referring to the type of activity engaged in by each person during the week prior to the census and the concept of remunerated worker, referring to workers usually involved in an occupational activity for which they receive income, including those currently employed and those usually employed but not during the previous week. The data cited in this study on female employment for 1953 refer to the latter definition of employment, since information on economic sector and occupation were only gathered for

this group. In addition, the census of 1953 was conducted during the sugarcane harvest. The census of 1970 utilized the concept of labor force, referring to the type of activity engaged in by each person during the week prior to the census. Similarly, the 1979 National Demographic Survey also utilized the concept of labor force, referring to the previous week.

32 Since November 1980, state and cooperative enterprises and private enterprises, such as some farms and small repair shops, have been allowed to hire their own workers without mediation from the Ministry of Labor, which had previously assigned workers to positions. The goal of this policy is to free individual enterprises from inefficient bureaucratic practices. Many state enterprises will now be classified as self-financing and will have to show an annual profit. This new economic management and planning system, including strict accounting methods, manpower controls, cost accounting, and incentive pay, was reportedly functioning in all 441 state enterprises by mid-1981 (Latin America Weekly Report, July 31, 1981).

33 During the 1970s, full-time boarding schools for secondary education were constructed, based on the work-study principle. By 1978-79, there were reportedly 402 escuelas en el campo with 217,000 students, accounting for 34 percent of total secondary enrollment (JUCEPLAN, C.E.E., 1979).

34 In addition, technical medical personnel are trained in approximately 30 specialties, with quotas, plans of study, and allocation of graduates to provincial services set by the Central Planning Agency (JUCEPLAN) and the Ministry of Public Health. By 1980, there were 14,156 nurses, 24,357 other middle-level technicians, and 17,274 auxiliary nurses and dental assistants (Ministerio de Salud Publica de Cuba, 1981).

APPENDIX 1

DATA SOURCES

Analysis of the Cuban demographic situation is facilitated by an abundance of data, including eight censuses since 1899 (1899, 1907, 1919, 1931, 1943, 1953, 1970, and 1981). The census of 1953 provides the most recent prerevolutionary data with the 1970 national census and preliminary results from the 1981 census available for the postrevolutionary period. Census data prior to 1959 are considered fairly accurate according to CELADE evaluations, with the 1931 census judged to be the most deficient (see Appendix 2). Cuba's national statistical system is coordinated at the ministerial level by the Comite Estatal de Estadisticas (CEE--the State Committee for Statistics), which publishes data on births, deaths, marriages, and divorces, as well as the Anuario Demografico de Cuba. The Central Planning Board (JUCEPLAN) directs the operations of the National Census Office (ONCE), which includes the Department of Demography. Teaching, research, and advisory services in demography are also provided by the Center for Demographic Studies (CEDEM) of the University of Havana. Data are gathered in each of the 169 municipalities in accordance with models developed by the Committee. Births are registered at hospitals and in the State Civil Register, and deaths are registered by the Ministry of Public Health (MINSAP) following World Health Organization guidelines. All health statistics are compiled and processed by the Ministry of Public Health, an organization within the Central Planning Board (JUCEPLAN) (Salcedo and Joly, 1979).

Until 1964, vital statistics were calculated on the basis of civil registration data, although the latter were considered more deficient than census data. For years since 1965, annual data on fertility published by

the Cuban government correspond not just to the actual number of births registered, but to estimates corrected for underregistration through use of the National Registry of Consumers, which records data on the number of surviving births as the basis of the rationing system. The proportion of births delivered and recorded in hospitals increased from 77 percent in 1966 to 98 percent in 1978. In 1978, approximately 99 percent of all Cuban births were registered the same year (Ministerio de Salud Publica de Cuba, 1979; Comite Estatal de Estadisticas, 1980). In 1970, Cuba revised its previous mortality and fertility statistics in accordance with the results of the 1970 National Census of Population and Housing. Statistical procedures for collecting morbidity and mortality data, last revised in 1977, include a continuous registration of perinatal deaths since 1968. The accuracy of these statistics is evaluated in Appendix 2. Future plans also exist for a National Statistical Information System, providing data at the national, provincial, and municipal levels.

Despite the nearly complete coverage achieved in birth registration, more detailed data on national fertility trends and differentials are usually limited to provincial comparisons and age-specific rates. Recently, however, the State Committee on Statistics, the Institute for Health Development, and the Center for Demographic Studies at the University of Havana have initiated additional basic research on mortality and fertility. The National Demographic Survey of 1979, conducted by the State Committee on Statistics, offers data on levels and trends in mortality and fertility, desired family size, and socioeconomic and geographic differentials in fertility and mortality. This survey also served to perfect methods and procedures for the recent 1981 Population and Housing Census. The Institute for Health Development is conducting a series of studies on infant and perinatal morbidity and mortality, and the National Commission on Maternal Mortality analyzes all maternal and infant deaths. A 1972 anthropometric study gathering data on the physical growth of 56,000 Cuban children from birth to age 20 has also been conducted by the Ministry of Public Health, the University of Havana, and the Central Planning Board, with assistance from the Federation of Cuban Women.

Data on fertility regulation pertain primarily to aggregate national statistics on total abortions, legal abortions, and other abortions, available on an annual

basis, as well as abortion-related mortality. Tabulations on the incidence of reported abortions by age group, parity, or the socioeconomic characteristics of abortion recipients have been gathered in KAP-type community fertility surveys and local polyclinic and hospital investigations, but not on the national level. Data on knowledge of contraceptive methods, contraceptive prevalence, and previous use are similarly limited to periodic community fertility surveys conducted in the early 1970s and one survey conducted in 1980. No data have been collected on rates of continuation, reported method side-effects, or contraceptive intentions, which would be particularly useful for service delivery. However, a future fertility survey of 3,000 households in Havana, rural Guantanamo, and a new community with an average birth rate will be undertaken by the Center for Demographic Studies of the University of Havana and the Federation of Cuban Women, with the assistance of the International Labour Organization (ILO), Population and Labor Policies Programme.

APPENDIX 2

AN EVALUATION OF CUBAN DEMOGRAPHIC STATISTICS, 1938-80

by Kenneth Hill

This evaluation is based on the following data sources: the population censuses of 1953 and 1970; registered births and deaths from the late 1940s to the late 1970s; two national surveys with demographic content--the 1974 National Survey of Income and Consumer Expenditure and the 1979 National Demographic Survey; and the statistics on net migration presented elsewhere in this study. These sources are discussed below in relation to fertility, mortality, migration, and population size and age structure.

FERTILITY

The principal source of information on fertility in Cuba is the sequence of registered births by age of mother, which provides age-specific fertility rates and thus total fertility by calendar years. This sequence is evaluated below by comparison with two other sources of information on fertility: lifetime fertility, or the average numbers of children ever born by age group of mother, available from the 1953 census, the 1974 survey, and the 1979 survey; and age distributions, or the actual numbers of children aged 0-4, 5-9, and 10-14, enumerated by the censuses of 1953 and 1970.

Comparison with Lifetime Fertility

Brass (1964) has proposed a procedure for evaluating current age-specific fertility rates by cumulating the rates and then interpolating between the cumulated values to obtain average parity equivalents for standard

five-year age groups. These parity equivalents can then be compared with reported average parities through computation of P/F ratios representing factors by which the current fertility rates have to be adjusted to be consistent with reported average parities. If fertility in the recent past has been constant, an average of these factors over an age range regarded as most reliable can be used to correct the current age-specific fertility rates under the following assumptions: that the age pattern of the current rates is correct, and that the average parities of at least the younger women reflect the true level of fertility. Even if fertility has not been constant, as it has not been in Cuba over the last 40 years or more, lifetime fertility for women in their twenties reflects births over a fairly short period preceeding the survey; therefore, the P/F ratios for these women provide some indication of the quality of the reporting of births around the time of the survey.

The application of a slight modification (U.N., 1983) of the original procedure to the three time points available for Cuba is shown in Table A.2.1. For 1953, the P/F ratios show a U-shaped pattern with age: they dip from values above 1.0 for women under 25 to values below unity from ages 25-39, and rise again to above unity for women 40 and over. The ratio for women aged 15-19 is very high; however, it should be disregarded since it is very sensitive to the interpolation procedure and since it is frequently distorted when birth registration and census or survey data are combined, probably because of different age misreporting in the two sources. The remaining ratios average about unity and suggest approximate consistency between current and lifetime fertility levels. When interpreted in terms of fertility trends, the age pattern of the ratios suggests a recent decline in early childbearing, a recent increase between ages 25 and 34, and a recent decline at later ages, though in view of possible data errors and migration effects, such a strict interpretation is unwarranted. This application can thus be regarded as confirming a level of total fertility around 3.6 and hence a birth rate of around 28 per 1,000 for 1953.

For 1974, the age pattern of the P/F ratios is dramatically different: it shows a monotonic rise from values close to unity for women under 25 to values over 1.4 for those over 40. This pattern is typical of applications to populations with recent fertility declines; moreover, the closeness to unity of the ratios

TABLE A.2.1 Application of P/F Ratio Technique, 1953, 1974, 1979: Cuba

Age Group	Average Parity	Age-Specific Fertility Rates	Cumulated Parity Equivalent	P/F Ratio
1953				
15-19	0.183	.0589	0.088	2.07
20-24	0.917	.2056	0.782	1.17
25-29	1.770	.2036	1.850	0.96
30-34	2.547	.1389	2.714	0.94
35-39	3.168	.0791	3.253	0.97
40-44	3.606	.0287	3.516	1.03
45-49	3.992	.0042	3.588	1.11
1974				
15-19	0.221	.1190	0.219	1.01
20-24	1.114	.1890	1.077	1.03
25-29	2.213	.1310	1.886	1.17
30-34	3.067	.0880	2.451	1.25
35-39	3.513	.0187	2.686	1.31
40-44	3.877	.0093	2.753	1.41
45-49	4.055	.0023	2.783	1.46
1979				
15-19	0.162	.0960	0.176	0.92
20-24	0.992	.1520	0.871	1.14
25-29	1.854	.0990	1.506	1.23
30-34	2.661	.0590	1.909	1.39
35-39	3.242	.0102	2.058	1.58
40-44	3.677	.0051	2.094	1.76
45-49	3.933	.0013	2.110	1.86

for young women indicates that the age-specific rates obtained from registered births can be accepted as satisfactory. The application thus supports a total fertility rate of 2.8 for 1974, implying a birth rate of around 22 per 1,000.

For 1979, the age pattern of the P/F ratios shows even more clearly the effect of declining fertility, with even the ratio for women aged 20-24 being substantially above

unity. Given the obvious fertility decline, no adjustment of the registered births is warranted; in the absence of indications of omission of births, the total fertility rate of 2.1 for 1979 is accepted. However, in view of the relatively high P/F ratio for women aged 20-24, the support for this value is somewhat weaker than that for the corresponding 1974 application.

Two developments of the P/F ratio procedure are specifically intended for conditions of changing fertility (U.N., 1983). One uses information on cohort parity changes between two surveys to compute an intersurvey parity distribution; this hypothetical distribution is then compared with cumulated average age-specific fertility rates for the intersurvey period in the normal way. The application of this method to the 1974-79 period is shown in Table A.2.2. Excluding the unreliable value for women aged 15-19, the P/F ratios range from 1.014 to 1.058 and show an impressive degree of consistency with age. Although the results could be interpreted as supporting an upward adjustment to registered births of about 3 percent, the direction of likely biases is upward; therefore, the results are taken as supporting the reported age-specific rates. The intersurvey estimate of total fertility--2.4--falls neatly between the 1974 and 1979 estimates. The removal of any trend from the P/F ratios supports the general accuracy of all the data used. The second approach cumulates age-specific fertility rates derived from registered births for cohorts of women and compares these cumulated values with average parities of those cohorts reported in a survey. The

TABLE A.2.2 Comparison of Period Fertility Rates with Cumulated Parity Changes, 1974-79: Cuba

Cohort Age Group, 1979	Average Parity		Cumulated Parity Change	Age-Specific Fertility Rates	Cumulated Parity Equivalent	P/F Ratios
	1974	1979				
15-19	0.0	0.162	0.162	.1015	0.187	0.87
20-24	0.221	0.992	0.933	.1600	0.921	1.01
25-29	1.114	1.854	1.673	.1055	1.594	1.05
30-34	2.213	2.661	2.121	.0625	2.006	1.06
35-39	3.067	3.242	2.296	.0350	2.243	1.02
40-44	3.513	3.677	2.460	.0145	2.361	1.04
45-49	3.877	3.933	2.516	.0035	2.407	1.05

TABLE A.2.3 Comparison of Reported Lifetime Fertility, 1974 and 1979 with Cohort Fertility Cumulated from Registered Births: Cuba

	1974 Survey			1979 Survey		
Age Group at Survey	Reported Parity	Cumulated Lifetime Fertility	P/F Ratio	Reported Parity	Cumulated Lifetime Fertility	P/F Ratio
15-19	0.221	0.254	0.870	0.162	0.212	0.764
20-24	1.114	1.127	0.989	0.992	0.979	1.013
25-29	2.213	2.158	1.026	1.854	1.842	1.007
30-34	3.067	n.a.		2.661	2.603	1.022

ratio of reported to cumulated parity represents an average correction factor for the reported births. This method has been applied using the 1974 and 1979 lifetime fertility data; age-specific fertility was cumulated from 1959 onward, allowing comparisons up to age groups 25-29 in 1974 and 30-34 in 1979. The results, shown in Table A.2.3, yield ratios very close to unity, except for ages 15-19, the age group for which the procedure used to apportion fertility rates between cohorts is least satisfactory.

To summarize, lifetime fertility data confirm the reliability of the age-specific fertility rates for 1953, 1974, and 1979, and suggest that birth registration has been effectively complete since at least the early 1950s. These data do not, however, directly confirm the fluctuations in fertility rates between the early 1950s and early 1970s, since such rates also depend on the population denominators used; the latter will have been affected by migration and are therefore uncertain.

Comparison with Age Distributions

In a population closed to migration, those aged 0-4 represent the survivors of births over the preceding 5 years, those aged 5-9 represent survivors of births 5 to 9 years earlier, and so on. If mortality rates are known, it is therefore possible to estimate the number of births for successive five-year periods preceding a census or survey from the reported age distribution. The number of births can then be used together with estimates of

average population size to estimate the birth rate for each period; age-specific fertility patterns can be used together with successive female age distributions to estimate age-specific fertility rates and thus total fertility.

Such an analysis is complicated by migration: not only are numbers of births affected (negatively by emigration, positively by immigration), but also, and perhaps more importantly, the estimates of population used in calculating rates are affected. Fortunately, the effects are in opposite directions, though they will only cancel out exactly when the age pattern of net migrants is the same as that of the general population. An attempt has been made to take migration into account since it has been such an important element of population change in Cuba over the period being considered: both the 1970 and 1953 census age distributions have been reverse-projected for 15 years to provide fertility estimates for the periods 1955-60, 1960-65, and 1965-70 from the 1970 census, and 1938-43, 1943-48, and 1948-53 from the 1953 census. The mortality parameters used in these projections were taken from the following section; the age patterns of fertility used to obtain estimates of total fertility were taken from registered births; and male and female net migration totals were taken from Table 30, with the age distribution of the migrants being derived from the age structure of 1970 United States residents of Cuban origin, adjusted for mortality, who had reported an arrival date between 1965 and 1970.

The birth rate and total fertility estimates obtained through this procedure for the six five-year periods are shown in Table A.2.4, together with comparable estimates from birth registration. The agreement here is impressive. The only substantial differences are for the period 1948-53, for which the reverse-projection estimates are lower than the previous estimates by some 7 percent. Typical age misreporting patterns might account for this discrepancy, though this explanation is contradicted by the fact that the reverse-projection estimates for the period 1943-48, which would be exaggerated by the typical age exaggeration of young children, are also lower than the previous estimates. It is therefore concluded that the reverse-projection results confirm the previous fertility estimates for the late 1930s to around 1970, except that they indicate that the fertility decline in the 1940s and 1950s took place somewhat earlier and somewhat faster than had previously been supposed.

TABLE A.2.4 Fertility Estimates Obtained from Reverse-Projection of 1953 and 1970 Age Distributions Compared with Other Estimates: Cuba

	Estimates from Age Distribution			Alternative Estimates		
Period	Birth Rate	Total Fertility	Sex Ratio at Birth	Birth Rate	Total Fertility	Sex Ratio at Birth
1938-43	33.5	4.22	104.8	33.5[a]	4.00[b]	n.a.
1943-48	31.2	3.95	104.0	32.5[a]		n.a.
1948-53	28.4	3.60	104.3	30.4[a]	3.60[c]	n.a.
1955-60	26.6	3.64	104.8	27.1[d]	3.76[e]	n.a.
1960-65	34.1	4.59	104.3	33.8[d]	4.67[e]	n.a.
1965-70	30.6	4.13	104.4	31.2[d]	4.29[e]	1.048[f]

[a]From Table 4, weighting adjacent five-year values.
[b]From Table 3, for 1943.
[c]From Table 3, for 1953.
[d]From Table 6.
[e]From Table 8.
[f]From registered births, 1967-70.

Conclusions Regarding Fertility

The evaluation of Cuba's fertility trends since 1940 described above shows an abnormally high degree of consistency between the various sources of fertility information. Although there is no very strong reason for rejecting the official figures quoted elsewhere in this report, a new series of fertility estimates based on the present evaluation and regarded as the best available is presented in Table A.2.5 for five-year periods from 1940 to 1980.

MORTALITY

The present evaluation of mortality data is based on two sources of information: registered deaths and enumerated population for the years 1953 and 1970, used to assess the completeness of death registration after childhood for those years; and information on children ever born and children surviving by age group of mother from the 1974 and 1979 surveys, used to obtain estimates of child mortality for the years preceding those surveys. Results for the latter are described first below since they are

TABLE A.2.5 Fertility Estimates by Five-Year Periods, 1940-80: Cuba

Period	Birth Rate	Total Fertility
1940-45	32.1	4.06
1945-50	29.5	3.74
1950-55	28.4	3.60
1955-60	26.6	3.64
1960-65	34.1	4.59
1965-70	30.6	4.13
1970-75	25.9	3.47
1975-80	17.2	2.18

needed to complete the life tables based on adjusted registered deaths after childhood.

Child Mortality

Using proportions dead among children ever born of mothers in standard five-year age groups, Brass (1964) has developed a procedure for estimating the probabilities of dying between birth and exact childhood ages. Trussell (U.N., 1983) has developed a modification of the original procedure that allows more flexibility in fertility and mortality patterns, while Coale and Trussell (1978) have proposed a procedure for dating the child mortality estimates to obtain period mortality risks under conditions of regular child mortality change over time. Trussell (U.N., 1983) has also developed a modification to be applied under conditions of fertility change, using parity ratios for true cohorts between two surveys as the basis for inferring the time pattern of births before the second survey. This latter modification has been applied to the 1979 data set, using in addition the average parities from the 1974 survey to allow for the sharp decline in fertility from the late 1960s.

Both Trussell modifications provide for the conversion of proportions dead into mortality risks using whichever of the four Coale-Demeny (1966) families of model life

tables is regarded as best representing the true pattern of child mortality for the application at hand. It therefore requires the choice of the most suitable pattern. Registered child deaths are available by sex for 1949, close to the 1953 census, and for 1970, a census year. Child mortality rates have been calculated (after adjusting the deaths for estimates of registration completeness, as described in the next section) for ages 0, 1-4, and 5-9, and the implied mortality levels in each model family have been found. Results are shown in Table A.2.6 which also shows the average levels in each family implied by the mortality rates for age groups from 10 to 54 and their mean absolute deviations from the average levels. Based on the information shown, the West family appears best to represent Cuban mortality around 1950, whereas by 1970, the East family, with high infant relative to child mortality, appears most satisfactory. The East pattern has accordingly been selected for the analysis of child survivorship data for the 1970s.

Table A.2.7 shows the application of the Trussell procedure to the 1974 and 1979 child survivorship data and the application of the true cohort procedure to the 1979 data. The estimated probabilities of dying by exact ages of childhood have been converted into East mortality levels and infant mortality rates; this permits easy comparison both between surveys and with the official infant mortality rates for the period 1958-81. Figure A.2.1 displays the official sequence of rates by year against those implied by the child survivorship data, using the East family of model life tables. For the period up to the early 1970s, the indirect estimates indicate a sequence that is highly consistent both between surveys and with the official rates, although it must be remembered that the indirect procedure smooths out such short-term fluctuations as the infant mortality peaks in the early and late 1960s shown by the official figures. It is interesting to note that the true cohort version applied to the 1979 proportions dead using parity ratios for true cohorts from 1974 and 1979 to infer the time distribution of births provides a sequence of estimates virtually identical to that obtained from the standard version when applied to the 1979 data only. This indicates that the bias introduced by declining fertility is small in this case. From the early 1970s on, the consistency between the indirect and official rates disappears: the indirect estimates indicate constant or even rising child mortality, while the

TABLE A.2.6 Age-Specific Mortality Rates and Implied Coale-Demeny Mortality Levels in Childhood, Around 1950 and 1970: Cuba

Age Group	Age-Specific Mortality Rate	Implied Mortality Level by Family			
		North	South	East	West
1949/1953					
Males[a]					
0	.05720	19.4	22.1	20.8	19.7
1-4	.00618	19.7	19.9	18.2	18.5
5-9	.00142	21.4	18.9	19.0	19.6
Average, 10-54		19.8	17.4	18.5	19.1
Mean Absolute Deviation, 10-54		1.71	1.20	0.76	0.68
Females[b]					
0	.05106	18.9	22.1	20.3	19.1
1-4	.00667	19.1	19.6	17.7	17.9
5-9	.00139	20.6	18.4	18.6	19.0
Average, 10-54		17.7	15.4	16.2	17.7
Mean Absolute Deviation, 10-54		1.02	1.36	0.75	0.53
1970					
Males[c]					
0	.04406	20.7	23.4	21.7	20.9
1-4	.00127	23.1	23.9	22.2	22.4
5-9	.00046	23.8	22.5	22.5	23.0
Average, 10-54		23.1	21.1	22.2	22.1
Mean Absolute Deviation, 10-54		0.20	0.63	0.57	0.45
Females[c]					
0	.03505	20.7	23.8	21.7	20.7
1-4	.00130	22.6	23.8	21.8	21.8
5-9	.00040	22.9	22.1	21.9	22.2
Average, 10-54		22.4	20.5	21.2	21.8
Mean Absolute Deviation, 10-54		0.17	0.27	0.32	0.33

[a]Deaths inflated by factor of 1.20 throughout.
[b]Deaths inflated by factor of 1.30 throughout.
[c]Deaths inflated by factor of 1.01 throughout.

TABLE A.2.7 Application of Child Mortality Estimation Procedures to 1974 and 1979 Child Survivorship Data: Cuba

Age Group	Children Ever Born	Children Surviving	x	Probability of Dying by Age x q(x)	Reference Date	Implied East Mortality Level
1974						
15-19	82,734	80,408	1	0.0285	1973.3	22.6
20-24	373,823	360,707	2	0.0360	1971.9	22.1
25-29	711,423	686,620	3	0.0347	1970.0	22.3
30-34	969,324	926,787	5	0.0441	1967.6	21.7
35-39	955,723	911,754	10	0.0473	1965.1	21.7
40-44	918,016	867,590	15	0.0556	1962.2	21.3
45-49	863,453	803,364	20	0.0698	1959.0	20.8
1979						
15-19	84,250	81,362	1	0.0381	1978.6	21.7
20-24	346,551	334,170	2	0.0369	1977.1	22.0
25-29	637,376	614,700	3	0.0350	1974.9	22.3
30-34	893,525	859,861	5	0.0372	1972.2	22.2
35-39	1,022,016	974,820	10	0.0465	1969.2	21.7
40-44	942,024	890,685	15	0.0541	1966.0	21.4
45-49	899,933	843,814	20	0.0614	1962.8	21.2

1979 True Cohort Fertility Ratios

Age Group 1979	Proportion Dead	Parity Ratios P(i-1, 1974) / P(i, 1979)	x	q(x)	Reference Date	Implied East Mortality Level
20-24	0.03573	0.2225	2	0.0357	1976.8	22.1
25-29	0.03558	0.6007	3	0.0343	1974.5	22.3
30-34	0.03768	0.8317	5	0.0361	1971.5	22.3
35-39	0.04618	0.9460	10	0.0451	1968.4	21.8

official figures show a continued rapid decline. This discrepancy, the only major one between recent official statistics and results of indirect procedures discovered in this evaluation, deserves further investigation. It arises for two indirect estimates--those based on reports of women aged 15-19 and 20-24 in 1979; the estimate based on reports of women aged 25-29 is also somewhat above the official sequence, though this discrepancy is less than three points on the infant mortality rate. The results of the true cohort version indicate that the discrepancy

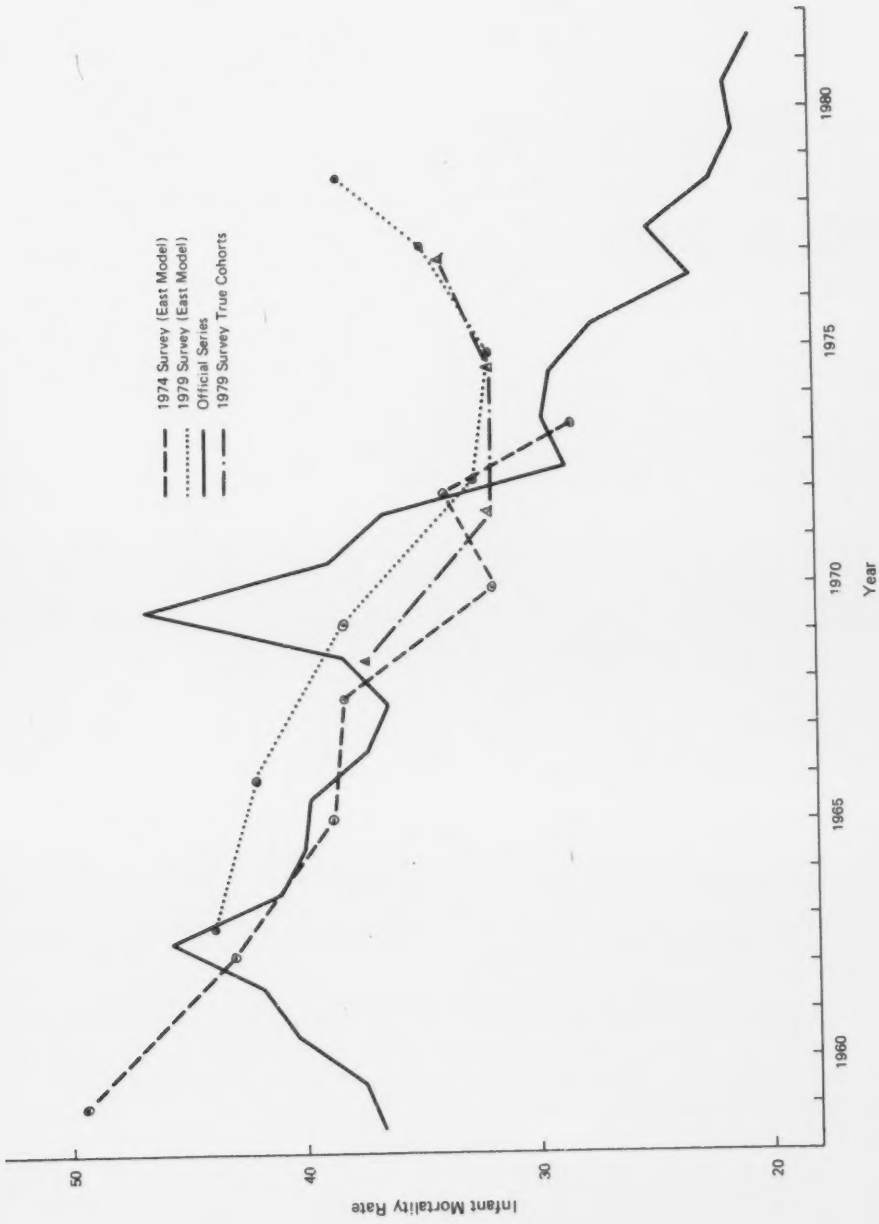

FIGURE A.2.1 Infant Mortality Rates from Vital Registration and Indirect Estimates from 1974 and 1979 Surveys: Cuba

does not arise from the effects of declining fertility on the indirect estimates; it is also clear from the dates obtained that it does not arise from the effects of declining mortality. The proportions of children reported as having died by women aged 15-19 and 20-24 in 1979 are therefore inconsistent with the official infant mortality rates for the late 1970s.

The official infant mortality rate represents an average rate for births to mothers of all ages. The indirect procedures assume that mortality risks of children do not vary with age of mother. However, applications frequently yield child mortality estimates based on reports of women aged 15-19, and to a lesser extent aged 20-24, that are markedly higher than the estimates based on reports of older women, that is, showing a pattern similar to the 1979 Cuban data. A plausible explanation for this pattern is that an above-average proportion of the children ever born of younger women are born to women from lower socioeconomic conditions: such women start their childbearing earlier, and since such children are typically exposed to above-average mortality risks, the proportion of children dead reflects not an average of mortality conditions for all children, but rather an average weighted toward children born into lower socioeconomic circumstances. The data from the 1979 survey on child survival by marital status show much higher proportions dead among children born to women in consensual than in legal unions, supporting the existence of mortality differentials by age of mother and socioeconomic status. Thus it is quite possible that the indirect child mortality estimates from 1979 based on the proportions dead among children ever born of women under 25 would be higher than the average mortality risks of children born between 1974 and 1979, without any overreporting of children dead. However, the size of the discrepancy between the indirect estimates and the official figures is too large to be explained entirely in such terms, and the lack of a similar pattern for the 1974 estimates is also puzzling. An additional, but unsubstantiated explanation, may be the inclusion or misreporting of abortions among nonsurviving children.

In summary, the sequence of official estimates of infant mortality from the late 1950s to the mid-1970s is strongly supported by the child survivorship data from 1974 and 1979. The sharp drop from the mid-1970s to 1980 is not supported by the available child survivorship data. However, in view of the evidence that birth and death registration was virtually complete in the late

1960s and early 1970s, and in the absence of evidence that registration has deteriorated, the official sequence is accepted, with the qualification that it is not independently supported and requires final confirmation from surveys in the early 1980s.

Estimates of child mortality for around 1953 have been obtained by adjusting child deaths for underregistration according to coverage estimates based on adult deaths. Results are shown in Table A.2.6. The indirect estimates from the 1974 survey reach back to the late 1950s. For this period, they suggest a mortality level about one higher (lower mortality) than the 1953 values. Although such an improvement is entirely plausible over a five-year period, the indirect estimates do not provide an immediate basis for evaluation of the 1953 values because of the time lag. Unfortunately, no other basis for evaluation exists since child mortality estimates have already been used to confirm the fertility estimates for the late 1940s using the 1953 census age distribution. Only the following conclusions can be drawn: that the child mortality estimates obtained by adjusting registered child deaths according to coverage estimates based on adult deaths provide internally consistent mortality rates using the West model family; that when these estimates are applied to the 1953 age distribution, they corroborate independently obtained fertility estimates; and that they give rise to plausible sex ratios at birth. Therefore, although their support is largely circumstantial, the estimates seem acceptable.

Mortality After Childhood

The only source of information on adult mortality is registered deaths by sex and age group. Such data are published for the period from the late 1950s to the early 1970s and also for 2 years in the late 1940s, though only for summary age groups above age 30. Brass, Preston, and Coale have developed a number of techniques for assessing the completeness of coverage of registered deaths by comparing the age distribution of deaths with that of the population on the basis of stable population relationships (see U.N., 1983 for a detailed description of these techniques). Two of these techniques--the Brass growth balance equation and the Preston-Coale procedure for comparing the observed population of each age group with the population estimated on the basis of age-group-

specific registered deaths for that and subsequent age groups--have been applied using the 1953 and 1970 census age distributions and 1949 and 1970 registered deaths. The date discrepancy for 1949-53 is not important: as long as the age pattern of deaths would not have changed between 1949 and 1953, the estimates of completeness will be relative to the 1953 population and thus provide valid adjustment factors, though not valid estimates of completeness in 1949. The 1949 deaths for broad age groups were split up into deaths for five-year age groups using a model life table and the 1953 age distribution.

Because the Cuban population has clearly not been stable in recent decades, the assumption of stability for the application of these procedures requires examination. Fluctuations in fertility, such as those occurring between 1950 and 1970, will introduce irregularities but little overall bias; the fertility decline from the late 1960s will have no impact since it has no effect on the population over 5 by 1970; the presumed fertility decline before 1950 was probably fairly slow and thus will also have only a limited impact. Mortality decline has apparently been steady but not extremely fast, at least until the 1970s, and such declines do not have a large impact on the Preston-Coale procedure, though they tend to bias completeness estimates downward. Migration is a more serious problem; this is especially so for 1970 since emigration was at its highest during the 1960s. Migration that has no effect on the age distribution (equal migration rates at all ages) will have no effect on the method: neither the age distribution of deaths nor that of the population will be altered, though the absolute numbers of both will be changed. Since the Cuban emigration of the 1960s shows broadly similar numbers of male and female emigrants, the age distribution of the emigrants may have been fairly close to that of the overall population, though age-specific growth rates between 1953 and 1970 are low between the ages of 10 and 50, suggesting predominantly young and middle-age adult emigration. If the emigrants were preponderantly children and young adults, the age distribution of the remaining population will be older than that of the stable population, implying heavier mortality and thus leading to underestimates of death registration completeness. A modification of the original Preston-Coale procedure using age-specific growth rates in place of the assumed stability could have been used to remove the effects of fertility and mortality changes, except that

the growth rates for age groups between 1953 and 1970 would still be affected by migration. The growth rates between 1953 and 1970 show consistent patterns by sex; rates are around 2.8 percent under age 10, drop to an average of around 1.5 percent between ages 10 and 50 and rise to very high average levels of around 4 percent over age 50. Major distortions introduced by migration should show up in the results of the Preston-Coale procedure in the form of either an implausible growth rate or a marked pattern in completeness estimates with age; in general, substantial emigration of typical age pattern is likely to result in underestimates of death registration completeness.

Table A.2.8 shows completeness estimates and growth rates for 1953 and 1970 for males and females using both the Brass and Preston-Coale procedures. For the Brass method, straight lines were fitted to the partial birth and death rates by a trimmed group mean approach, underweighting the first three and last three points. For the Preston-Coale approach, an open age interval of 55+ was used to reduce the effects of age exaggeration. The growth rate was found iteratively as the value giving the closest approximation to a horizontal series of completeness estimates by age, and the final completeness estimate was found as the average of the values over the age range 10 to 50. The completeness estimates by age obtained by

TABLE A.2.8 Estimates of Completeness of Death Registration by Sex, 1949-53 and 1970, from Brass and Preston-Coale Methods: Cuba

	Male		Female	
Method	Completeness	Growth Rate	Completeness	Growth Rate
1949 Deaths Relative to 1953 Enumeration				
Brass	0.809	.0220	0.922	.0298
Preston-Coale	0.831	.0225	0.770	.0270
1970 Deaths Relative to 1970 Enumeration				
Brass	0.874	.0203	0.854	.0239
Preston-Coale	0.987	.0215	0.857	.0238

the Preston-Coale procedure are plotted for each application in Figure A.2.2. From this figure, it will be seen that the 1970 applications yield a highly consistent series of completeness estimates for both males and females, though there is a substantial difference by sex in the overall completeness level--from virtual completeness for male deaths to only 86 percent completeness for female deaths. The Brass procedure gives consistent estimates of around 86 percent for both male and female completeness, but gives substantially different growth rates by sex. In view of oddities in the female age distribution and the greater effect of declining mortality on the Brass procedure, the Preston-Coale result for male deaths, implying a level of registration consistent with the 1970 census coverage, has been accepted for both sexes. For 1953, the male-female discrepancy is even more marked, particularly for the Brass approach, and the consistency of the Preston-Coale completeness estimates by age leaves much to be desired. Once again, in view of the apparent superiority of the male age distribution and the method's greater robustness to mortality change, the Preston-Coale estimate of registration completeness for male deaths of 83 percent has been accepted for 1953 for both males and females.

The completeness factors just selected were inverted to give adjustment factors. These factors were then used to adjust registered deaths for each age group, adjusted age-specific mortality rates calculated, and the implied mortality levels within each Coale-Demeny model family found. Results are shown in Table A.2.9. The mean mortality level for the age range 10 to 54 is also given, together with a measure of goodness of fit--the average absolute deviation of each observation in this age range from the mean. For 1953, it will be noticed that the West mortality pattern gives the best fit for both males and females. It may also be noted that the female mortality levels are lower than those for males, implying relatively heavier female mortality, even using the same adjustment factor for both sexes; the use of a larger adjustment factor for females, as would be supported by the Preston-Coale procedure, would give rise to an even larger imbalance. For 1970, the best fit to the adjusted age-specific mortality rates is provided by the North family for the age range 10 to 54, though all the models provide very good fits. In view of the good fits provided by the East family in childhood and the possible effect of age exaggeration on the rates, the East family

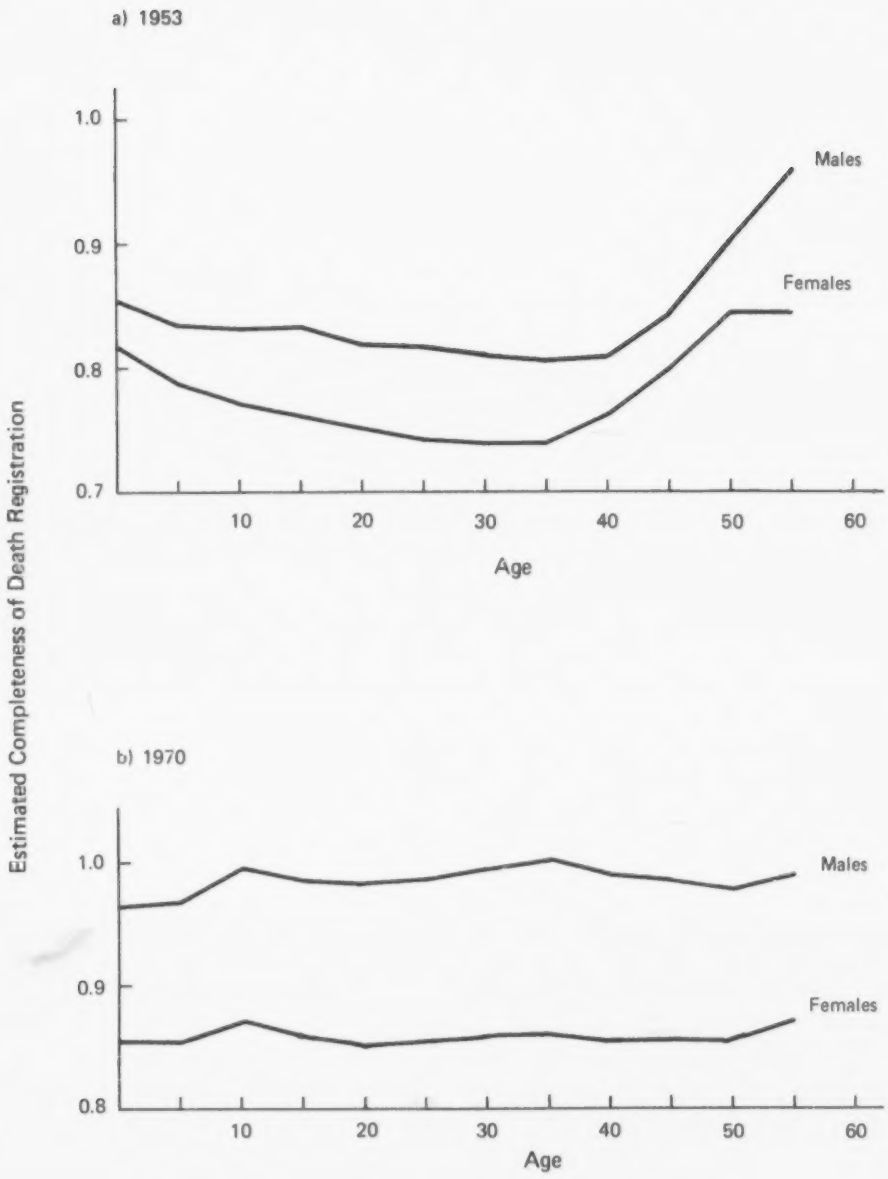

FIGURE A.2.2 Estimates of Death Registration Completeness N(a+)/N(a+) from Preston-Coale Method, 1949/53, 1970: Cuba

TABLE A.2.9 Age-Specific Mortality Rates from Adjusted Registered Deaths and Implied Coale-Demeny Mortality Levels: Cuba

Age Group	Age-Specific Mortality Rate	Coale-Demeny Mortality Level by Family			
		North	South	East	West
a) 1949 Deaths (adjusted by 1.205) and 1953 Population					
Males					
5-9	.00142	21.36	18.90	19.00	19.57
10-14	.00097	21.37	19.20	19.39	20.09
15-19	.00166	21.81	18.48	19.80	20.11
20-24	.00288	20.84	17.78	18.60	19.01
25-29	.00298	20.79	17.63	18.44	19.08
30-34	.00321	20.83	18.31	18.62	19.36
35-39	.00361	20.79	18.51	19.28	19.88
40-44	.00704	17.45	15.46	16.40	17.63
45-49	.00890	17.34	15.82	17.52	18.32
50-54	.01283	16.91	15.57	18.06	18.41
55-59	.01710	16.81	16.70	20.04	19.74
60-64	.02317	18.02	18.40	21.61	21.32
65-69	.03581	17.87	18.41	21.72	21.50
70-74	.05639	17.79	19.30	22.16	21.65
75-79	.09000	17.55	20.63	22.41	21.61
Average Level, 10-49		19.79	17.42	18.46	19.10
Mean Absolute Deviation, 10-49		1.71	1.20	0.76	0.68
Females					
5-9	.00129	20.81	18.67	18.82	19.24
10-14	.00089	20.91	18.59	18.87	19.62
15-19	.00202	18.71	16.78	16.80	18.09
20-24	.00271	18.40	16.68	16.80	18.09
25-29	.00314	18.41	16.59	16.86	18.11
30-34	.00356	18.42	16.31	16.97	18.25
35-39	.00412	18.41	16.15	17.15	18.40
40-44	.00598	17.24	14.38	15.57	17.20
45-49	.00713	16.98	14.18	16.10	17.74
50-54	.01005	16.52	13.92	16.08	17.71
55-59	.01357	16.51	14.46	17.20	18.26
60-64	.01691	18.89	17.58	20.04	20.70
65-69	.02754	18.88	17.97	20.58	20.84
70-74	.04541	18.87	19.09	21.43	21.21
75-79	.07415	18.84	20.39	22.29	21.73
Average Level, 10-49		18.43	16.21	16.89	18.19
Mean Absolute Deviation, 10-49		0.69	0.98	0.58	0.43

TABLE A.2.9 (continued)

Age Group	Age-Specific Mortality Rate	Coale-Demeny Mortality Level by Family			
		North	South	East	West
b) 1970 Deaths (adjusted by 1.011) and 1970 Population					
Males					
5-9	.00046	23.83	22.47	22.44	22.95
10-14	.00054	23.06	21.68	21.95	22.12
15-19	.00127	22.82	19.71	21.17	21.30
20-24	.00151	23.45	20.48	21.96	21.88
25-29	.00160	23.32	20.55	21.83	21.74
30-34	.00176	23.37	21.19	21.82	21.82
35-39	.00224	23.00	20.98	21.79	21.87
40-44	.00289	22.97	21.60	22.32	22.35
45-49	.00418	22.75	21.87	22.98	22.86
50-54	.00645	23.04	22.21	23.80	23.20
55-59	.00993	22.33	22.35	25.00	23.78
60-64	.01632	22.18	21.92	25.00	23.83
65-69	.02580	22.31	21.95	25.00	25.00
70-74	.04946	19.83	20.95	23.57	23.16
75-79	.06625	22.70	25.00	25.00	25.00
Average Level, 10-54		23.08	21.14	22.18	22.13
Mean Absolute Deviation, 10-54		0.20	0.63	0.57	0.45
Females					
5-9	.00040	22.93	22.08	21.91	22.22
10-14	.00045	22.55	21.01	21.01	21.53
15-19	.00086	22.14	20.11	20.49	21.02
20-24	.00105	22.58	20.61	20.85	21.47
25-29	.00121	22.64	20.70	20.94	21.62
30-34	.00142	22.47	20.75	21.13	21.74
35-39	.00178	22.29	20.59	21.36	21.90
40-44	.00247	22.53	20.49	21.38	21.99
45-49	.00337	22.37	20.36	21.88	22.50
50-54	.00554	22.06	19.77	21.51	22.21
55-59	.00756	22.10	20.20	22.16	22.86
60-64	.01227	22.12	20.37	22.35	22.88
65-69	.01983	22.51	20.92	22.98	23.40
70-74	.03452	22.46	21.63	23.56	23.64
75-79	.05046	23.95	23.88	25.00	25.00
Average Level, 10-54		22.40	20.49	21.17	21.78
Mean Absolute Deviation, 10-54		0.17	0.27	0.32	0.33

was selected as an adequate representation of Cuban mortality in 1970 at all ages. It may be noticed that the male-female differential in mortality level is still about one level for the East family, though smaller for the other families. The infant mortality rate for both sexes implied by a 22.2 East level for males and a 21.2 East level for females is 38, in satisfactory agreement with the estimates given in Figure A.2.1.

MIGRATION

The official figures on Cuban migration are widely believed to understate the true flows out of the country since the revolution. Unfortunately, the possibilities for evaluating migration data are more limited than those for evaluating fertility and mortality data. There are two main checks: arrivals of Cuban nationals, or de facto residents of Cuban origin, in other countries, notably the U.S. as the major recipient; and changes in the de facto Cuban population over time. Although these checks are not in general highly reliable, they may be expected to reveal any major problems with the official figures.

A comparison of the number of Cubans recorded as arriving in the United States (Table 29) and the official Cuban net migration totals for the period 1959-79 shows a remarkable degree of consistency. Table A.2.10 gives the numbers from the two sources for approximately the same five-year periods. U.S. arrivals exceed net Cuban emigration for all periods except the early 1970s; this

TABLE A.2.10 Comparison of Cuban Arrivals in the U.S. and Net Emigrants from Cuba by Five-Year Periods, 1960-79

Period	Cuban Arrivals in U.S.	Net Cuban Emigrants
1960-1964	247,341	208,535
1965-1969	223,852	211,422
1970-1974	149,772	156,799
1975-1979	24,303	20,294

would be expected unless illegal immigration to the U.S. were substantial, since no allowance is made for return or onward migration. Although the data are not adequate to establish exactly what was going on, the figures in Table A.2.10 clearly show that the official Cuban emigration data are of the right order of magnitude.

A further comparison is available with U.S. 1970 census data on the Cuban-born population by age and date of arrival. Those who arrived between 1965 and 1969, classified by age and sex, can be adjusted for mortality on the assumption that the arrivals were evenly spread over the period; this will permit an estimate of the number of Cuban arrivals, net of return or onward migrants. Table A.2.11 compares the resulting numbers with the official figures on net emigrants; a rough age breakdown has also been introduced, obtained for the Cuban statistics by assuming that the age pattern of migrants in years for which no age breakdown is available was the same as that in years for which figures are available. Agreement is again satisfactory: the 1970 U.S. census suggests the net arrival of some 204,000 Cubans between 1965 and 1969, while the Cuban data show a net emigration of about 230,000 over the same period. The two figures should not be expected to agree exactly: some emigrants will have gone to destinations other than the U.S.; moreover, the Cuban figures cover all countries of origin and destination, while the U.S. figures cover only net gains of those of Cuban origin. If the U.S.

TABLE A.2.11 Comparison of the Cuban-Born Population of the U.S. in 1970 with Arrival Dates Between 1965 and 1969 (adjusted for mortality) with Net Cuban Emigrants for the Period, by Sex and Broad Age Groups

	Male		Female	
Age Group	Net Emigrants	U.S. Cuban-Born	Net Emigrants	U.S. Cuban-Born
0-14	35,928	29,332	33,625	29,284
15-59	63,514	52,830	70,025	69,170
60+	12,345	8,898	14,478	14,736
Total	111,787	91,060	118,128	113,190

figures were substantially larger than the Cuban figures, it would be reasonable to assume that the Cuban figures were underestimates. As it is, with a difference of only some 12 percent between the figures and reasonable agreement by age, the U.S. data again confirm the order of magnitude of the Cuban figures and provide no grounds for rejecting or revising their levels.

The third procedure for evaluating the migration figures is to incorporate them into population projections and see how well the observed population structures can be replicated using estimated fertility, mortality, and migration rates. However, since this procedure provides a simultaneous check on all three elements of population change, it is discussed in the next section.

POPULATION SIZE AND AGE STRUCTURE

If the fertility, mortality, and migration estimates available for Cuba are correct, it should be possible to obtain the population size and age structure for one period from any other period by projection. The Cuban population by age group and sex is available for the census years of 1953 and 1970; provisional results for rather unusual age groups are available from the 1981 census; and a population total is available for 1943. The 1953 population has been projected backward to 1938 and forward to 1983, while the 1970 population has been projected backward to 1940 and forward to 1985. The assumptions underlying these projections, as regards total fertility, Coale-Demeny model life table levels, and net migrants by sex for each period are shown in Table A.2.12. Age patterns of fertility were adopted from Tables 3 and 8, while the age pattern of migrants was based on that of Cuban nationals resident in the U.S. in 1970 who had arrived during the 5 previous years, adjusted for mortality.

Table A.2.13 shows the ratio of the age and sex composition of the projected populations based on the 1953 and 1970 censuses to that of the enumerated populations in 1953 and 1970. For 1970 and 1981, the projected and enumerated populations agree closely, at least in totals, the 1970 projection being about 2 percent smaller than the enumerated population. The age structures, however, show some interesting patterns. The projection has a large excess in the age group 10-14 and a large deficit in age groups 15-19 and 20-24; age

TABLE A.2.12 Assumptions of Population Projections from 1953 and 1970 Bases: Cuba

Period	Total Fertility	Coale-Demeny Mortality Parameters				Net Migrants	
		Male		Female			
		Level	Family	Level	Family	Male	Female
1953 Base							
1938-43	4.22[a]	17.8	West	16.8	West	-25,000	-25,000
1943-48	3.95[a]	18.3	West	17.3	West	-25,000	-25,000
1948-53	3.60[a]	18.8	West	17.8	West	-10,000	-11,920
1953-58	3.60	b	b	b	b	--	--
1958-63	4.50	b	b	b	b	-64,308	-107,358
1963-68	4.35	21.7	East	20.7	East	-79,432	-91,599
1968-73	3.85	22.4	East	21.4	East	-105,439	-99,288
1973-78	2.53	23.2	East	22.2	East	-9,328	-2,999
1978-83	1.80	24.0	East	23.0	East	-65,000	-65,000
1970 Base							
1940-45	4.02[a]	18.0	West	17.0	West	-25,000	-25,000
1945-50	4.01[a]	18.5	West	17.5	West	-19,000	-19,000
1950-55	3.89[a]	19.0	West	18.0	West	-6,000	-6,000
1955-60	3.64[a]	b	b	b	b	2,000	2,000
1960-65	4.59[a]	b	b	b	b	-84,400	-115,703
1965-70	4.12[a]	21.8	East	20.8	East	-115,307	-133,829
1970-75	3.47	22.6	East	21.6	East	-63,003	-43,941
1975-80	2.18	23.4	East	22.4	East	-35,000	-35,000
1980-85	1.70	24.0	East	23.0	East	-42,500	-42,500

[a]Level defined by reverse-projected population
[b]Interpolation between adjacent life tables

misreporting in 1970 is the likely culprit, rather than misspecification of fertility or mortality in the 1950s. Above age 45, the projected population is too small, particularly for males. This deficit probably arises from two sources: an exaggeration of age in 1953, exposing the population to higher mortality risks in the projection than their true risks, and a further exaggeration of age in 1970, particularly for males. The pattern of the discrepancies in 1970 between the projected and enumerated populations strongly suggests that the discrepancies arise largely from age misreporting; the discrepancy in the total may arise partly from age exaggeration in 1953 and partly from a slight underenumeration in 1953 relative to 1970 on the order of 1 or 2 percent.

TABLE A.2.13 Ratios of Projected to Observed Populations, by Sex and Age Groups, 1953, 1970, 1981: Cuba

	1953		1970	
	Reverse-Projected from 1970: Observed		Projected from 1953: Observed	
Age Group	Male	Female	Male	Female
0-4	1.082	1.112	1.012	1.007
5-9	1.011	1.045	1.000	0.994
10-14	0.962	0.991	1.122	1.119
15-19	1.067	0.974	0.914	0.891
20-24	0.946	0.975	0.958	0.927
25-29	1.049	0.991	1.037	0.996
30-44	1.057	1.008	0.998	1.028
45-74	1.377	1.393	0.917	0.966
75+	0.978	1.050	0.605	0.571
Total	1.091	1.076	0.980	0.984

	1981	1981
Age Group	Projected from 1953: Observed,[a] Both Sexes	Projected from 1970: Observed,[a] Both Sexes
0-16	0.998	1.034
17-29	1.049	1.000
30-44	1.015	1.041
45+	0.965	0.977
Total	1.005	1.014

[a]Provisional figures.

A comparison between the 1953 enumerated population and the reverse-projected 1970 age distribution is less satisfactory. Overall, the reverse-projected population is some 8 percent larger than the observed population, though almost all of this excess is accounted for by large discrepancies in the age group 45-74 (almost 40 percent larger in the projected than in the enumerated population) and for the age group 0-4 (almost 10 percent

larger in the projected population). For the age group 5-44, the reverse-projected male population is 2 percent larger than that observed, while the female populations differ by less than half a percent. The reverse-projected age group 5-44 is based on persons aged 22 to 61 in 1970; it depends only on their age structure in 1970, and the mortality and migration assumptions made in the projection, with migration being the main factor in this case. The reasonable agreement for the age range 5-44 thus supports the general level of the migration figures used. The very large excess of projected population aged 45-74 in 1953 probably arises from age exaggeration above ages 55 or 60 in 1970, a feature clearly visible in the death distribution applications presented above. The other possible explanation would be that the mortality assumed at older ages for the reverse projection was too high, though this explanation is not supported by the mortality evidence already discussed. The second large discrepancy is at ages 0-4, where the projected population based on respondents aged 17-22 in 1970 is 10 percent larger than the enumerated population; this excess is the manifestation in 1953 of the apparent exaggeration of age of teenagers in 1970. It is possible that the cohort aged 15-24 in 1970 really was large because of a birth boom between 1945 and 1955, seen neither in the official statistics for fertility nor in the 1953 age distribution; however, this must be regarded as unlikely, especially given the more normal size of the cohort aged 30-44 in 1981. The major discrepancies between the projected and enumerated 1953 populations seem more likely to arise from age misreporting in 1970 than from failure to specify reasonable mortality and migration assumptions.

The only age information from the 1981 census is provisional totals for both sexes combined and unusual age groups. Both the 1953- and 1970-based projections can be compared with the 1981 results, though a word of caution is required because of the massive short-term emigration from Cuba in 1980; standard five-year projection routines cannot handle such events satisfactorily. The effect of the emigration on the projected populations for 1981 will be underestimated, tending to make the projected numbers somewhat too large. In fact, the agreement is remarkably close overall and at all age groups except 45 and over; for this latter age group, the observed population is larger than the projections, a discrepancy that may well arise from a continuation at a reduced level of some age exaggeration in 1981.

CONCLUSIONS

The evaluations described in this Appendix show Cuban demographic data to be of very high quality. Even the migration data, the Achilles' heel of almost all demographic data systems, fit well into the overall picture, though the details of the migration assumptions and even the net numbers could be changed substantially without greatly affecting the overall consistency. One or two elements of the official series need revision: it seems likely that fertility had fallen to its 1950s low point virtually by the start of the decade; the 1970 age distribution is characterized by certain age exaggeration problems, particularly over 60 and from the age group 10-14 to the next two higher groups; and the rapid post-1970 decline in child mortality cannot be substantiated fully, though on the grounds of statistical continuity, the decline should be accepted as probably correct.

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CELADE: Centro Latinoamericano de Demografia
D.C.E: Direccion Central de Estadisticas
IPPF: International Planned Parenthood Federation
JUCEPLAN: Junta Central de Planificacion
UNFPA: United Nations Fund for Population Activities
WHO: World Health Organization

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5.17

COMMITTEE ON
POPULATION AND DEMOGRAPHY Report No. 27

Rapid Population Change in China, 1952-1982

Ansley J. Coale

Committee on Population and Demography
Commission on Behavioral and Social Sciences and Education
National Research Council

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This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

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PREFACE

This report, using analyses of recently available census and survey data on the population of China, presents the demographic history of China during the past 30 years. The report uses detailed assessments of data from a major 1982 fertility survey and the 1982 census of China, which became available at the end of 1983, to develop estimates of three major population processes for 1952-82: fertility, nuptiality, and mortality.

With the rapid expansion in world population in recent decades, fertility and its determinants have been urgent topics for research. Attempts to affect population growth have focused on reducing fertility, with some apparent effect. The peak rate of growth in the world's population has now passed although growth is still at a high level in almost all the developing countries. In absolute numbers, the increase in the world's population continues to rise: according to United Nations medium projections, more people will be added each year for the next 35-40 years than were added in 1980. In this context, China's recent rapid declines in fertility and mortality are remarkable; moreover, China's decline in fertility has contributed substantially to the modest reduction in the world rate of population growth.

This report on China is number 27 in a series of reports prepared by the Committee on Population and Demography and its several panels. (A complete list of these reports is printed on the inside back cover.) The committee was established in 1977 by the Commission on Behavioral and Social Sciences and Education of the National Research Council (NRC). Funded for a period of 5-1/2 years by the Agency for International Development (AID), the committee undertook three major tasks:

1. To evaluate available evidence and prepare estimates of levels and trends of fertility and mortality in selected developing nations;

2. To improve the technologies for estimating fertility and mortality when only incomplete or inadequate data exist (including techniques of data collection); and

3. To evaluate the factors determining the changes in birth rates in less developed nations.

About half of the reports resulting from these tasks are concerned with demographic estimates in less-developed countries and with methodology and the other half are concerned with the determinants of fertility.

In its early deliberations about which countries to include in its work, the committee did not select China for several reasons, primarily the nonavailability of an adequate data base for a scientific assessment of fertility and mortality trends. At that time, it was not foreseen that it would be possible later on to prepare a comprehensive report on the demography of China. However, the committee was interested in China, and, with cosponsorship by the NRC's Committee on Scholarly Communication with the People's Republic of China and modest support from the U.S. Department of State, a workshop on population research in China was held at the National Academy of Sciences in October 1980; the proceedings were published by the National Academy Press in 1981.

This report on China has been made possible by a grant from The Rockefeller Foundation and with support from the NRC Fund.*

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The committee and the National Research Council wish to thank Ansley J. Coale for preparing this report, and indeed for doing so within such a short period of time. Sincere thanks are also extended to the reviewers who both read the report on short notice and attended a review meeting in Washington in April 1984. Several other individuals assisted in the production of this report. Marleen Stern and Kathryn Reynolds typed the draft and tables in Princeton, and Barbara Vaughan assisted with computer tabulations. At the NRC, Lucy Santiago typed the camera-ready copy of text and tables, Eugenia Grohman edited the report, and Elaine McGarraugh handled all of the production editing details. The committee extends its gratitude to these individuals for their contributions to the report.

Finally, this is a fitting occasion to thank Ansley J. Coale for his leadership of the Committee on Population and Demography and his many contributions to its products. The committee's extensive accomplishments owe much to those contributions and especially to his effectiveness as committee chair.

Robert J. Lapham, Study Director
Committee on Population and Demography

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which seeks annual contributions from companies that are concerned with the health of U.S. science and technology and with public policy issues with technological content; and the National Academy of Sciences and the National Academy of Engineering endowments.

SUMMARY

In 1982 the People's Republic of China carried out a census with a more comprehensive interview schedule than ever before employed in China and using a very large, carefully chosen, and extensively trained field staff. The census was preceded by pilot surveys to test the instruments and field procedures. A tabulation of 10 percent of the individual returns has been completed, published in China, and made available abroad in limited circulation. Also in 1982 a fertility survey covering a very large sample of households (total population of more than 1 million) was conducted in China, and its results have been published in great detail in a special issue of the Chinese Journal Population and Economics. In addition, the distribution of the population by sex and single years of age as enumerated in the censuses of 1953 and 1964 has been recently released. This new information, supplemented by time series of registered births and deaths and end-of-year population totals extending back to the 1950s and by data from other large recent surveys, provides a sound basis for constructing an accurate and detailed history of the remarkable changes in fertility, mortality, and marriage that have occurred in China since the People's Republic was established.

The newly available information includes complete histories of marriage and childbearing of women up to age 67 in the 1/1,000 fertility survey of 1982. The responses have been analyzed and tabulated in the form of marriage rates and birth rates by single years of age in single calendar years from 1950 to 1981. When the survey data are combined and compared with the census data for 1953, 1964, and 1982 on numbers of persons by sex and single years of age, they pass a series of stringent tests of accuracy and consistency. The same analysis

reveals that official data on birth and death rates have understated the true numbers by a considerable margin. The tests support the substantive findings in this report on levels and changes in fertility, nuptiality, and mortality in China since 1950.

Fertility Rates. The birth rate in China has been higher than that listed in official sources. In the 1950s the birth rate was generally above 40 per 1,000 until a precipitous fall--from 42.5 per 1,000 in 1957 to 21.9 in 1961--that coincided with the Great Leap Forward and the ensuing years of economic disruption and famine. The post-crisis peak birth rate in 1963 was just short of 50 births per 1,000.

A more useful fertility measure, the total fertility rate (TFR)--the average number of children that would be born in a lifetime to women subject to the birth rates by age in a given period--was about 6.0 before the Great Leap Forward, declined to 3.3 in 1961, rose to 7.5 in 1963, returned to 6.0 in the mid-1960s, fell steeply to only 2.2 in 1980, and then rose slightly to over 2.6 in 1981 and 1982. The birth data on which these fertility rates are based are derived from the new detailed information, especially that from the fertility survey. It is clear that the number of births previously listed in official sources has been incomplete: by more than 15 percent in the 1950s, by less than 10 percent in the late 1960s and early 1970s, and by 15 percent or more since the intensification of the antinatalist program in 1979.

Age Pattern of Fertility. The age pattern of fertility of married women in the 1950s was a pattern of gradual decline in the rate of childbearing with age until age 30; the decline steepened after age 30 and especially after age 35. This age pattern closely resembles the early gradual and later steep decline of marital fertility rates with age of woman that is characteristic of populations in which couples practice little contraception or induced abortion. This age pattern of marital fertility in the 1950s supports the inference of little use of contraception. In the 1970s (and especially in 1980), by contrast, marital fertility rates fell very steeply with age of women after their late 20s, a pattern characteristic of very general resort to contraception to limit fertility after desired family size is reached.

In 1961, when the TFR fell to only a little more than half the TFR of 1955 or 1957, the fertility of married

women was very much reduced at all ages. A nearly uniform reduction in fertility at different ages is consistent with a quasi-biological cause of low fertility--i.e., low fertility was the result of disruption of normal life and famine-induced subfecundity rather than a large increase in the use of contraception. The unmatched post-crisis TFR of 7.5 in 1963 involved peak marital fertility rates at all ages. These high rates at all ages may also have a quasi-biological explanation. Newly married couples (there was a very high first-marriage rate in 1962) and couples resuming normal life are especially susceptible to the risk of childbearing since few of the women are protected from the risk of pregnancy because of nursing a previously born child.

Contraceptive Use. In 1981 contraception--mostly sterilization, the IUD, and contraceptive pills--was practiced by more than two-thirds of married women aged 15 to 49.

Mean Age at First Marriage. The mean age at first marriage of women was about 18.5 years in the 1940s, about a year older than that estimated for rural China in 1930. The mean age at marriage rose gradually (with some fluctuations) to a little more than 20 in 1970, and then steeply to more than 23 in 1979. There was then a slight decline, of about four- tenths a year, to a mean age of 22.7 years in the first half of 1982.

Effects on Fertility of Changes in Mean Age at First Marriage. The changing age of entry into marriage contributed strongly to changes in fertility. Had the noncontraceptive marital fertility rates at each age of the 1950s continued, the increase in age at marriage by itself, by exempting many younger women from the risk of childbearing, would have led to a TFR in 1980 that was 20 percent below the TFR of 1950--a hypothetical decline about one-third as great as the actual one. The rise in age at marriage in the 1970s would have produced (by a different mechanism) a 20 percent reduction in the TFR during that decade even if from 1970 on married women had successfully attained unchanging goals of restricted family size. This apparently anomalous effect--a 20 percent decline in TFR even though married women produce an unchanging total number of children per marriage--arises from the temporary reduction in the number of marriages that is caused by a rise in mean age at

marriage. About one-third of the reduction in the TFR from 1970 to 1980 was associated with the increase in age at marriage and would have occurred with constant duration-specific marital fertility rates.

When mean age at marriage ceases to rise, the diminution in the number of marriages caused by rising age at marriage ceases, and the number of the newly married women increases. In 1980-82 a sharp increase in the total first-marriage rate accompanied the termination and slight reversal of the increase in mean age at marriage. Most of the upturn in TFR after 1980 was the result of the marriage boom in 1980-82 and would have occurred with constant fertility rates at each duration of marriage. Upward pressure on the TFR will continue because the highest marital fertility rates occur one or two years after the date of marriage; the large number of marriages in 1981 and 1982 will inflate births in 1983 and 1984 even if the recently married have only one or two children.

Urban/Rural and Other Fertility Differences. Before the temporary sharp decline in the TFR that began in 1958, the TFR in the cities was about 10 percent below the rural TFR; about half of the difference in fertility can be ascribed to later marriage in the urban population. As shown in Figure 1, between 1960 and 1966, the urban TFR fell to about half the rural TFR, and it remained at about that fraction when the large reduction in rural fertility began in 1970. Other differentials in fertility that are usually present in the first years of a major reduction were present in China in 1981: fertility was lower for more educated women and for women in higher occupational categories; the minority ethnic groups had much higher fertility than the rural Han majority.

Future Trends in Fertility. Further upward pressure on the birth rate in the late 1980s is built into the age distribution of the Chinese population, shown in Figure 2. Women in their early 20s in 1982 were born in 1958-61, a period of greatly reduced birth cohorts. In the next few years the very large birth cohorts of 1963-70 will be in the normal ages of first marriage and thereafter in the very fertile years soon after marriage.

Male/Female Birth Ratios. The large-scale fertility survey recorded ratios of male to female births that were very close to the worldwide normal ratio of about 106

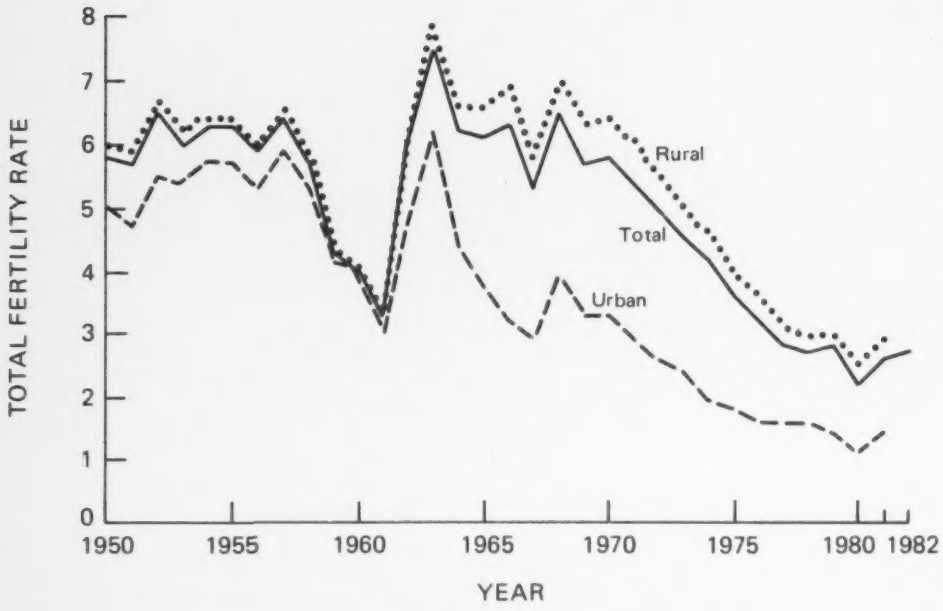


FIGURE 1 Total Fertility Rates for Urban and Rural Areas and for China, 1952-82: China

males per 100 females among first and second births in the rural population, but there were more than 112 males per 100 females for third- and higher-order births. The male/female ratio for urban births was somewhat higher (over 108) for first births, and much higher (about 118) among the small number (257) of births beyond the first. Experience in other populations is of slightly declining male/female ratios with birth order. Since stopping rules--no more births following a male--do not affect the male/female ratio and sex-selective abortion on a large scale does not seem possible in rural China, the explanation for the reported male/female birth ratios must be unreported higher-order female births. There may be a connection between failure to report a higher-order female birth in the survey and the occurrence of female infanticide, which has been widely reported (and deplored) in the Chinese press. Given the penalties imposed in the one-child campaign and the cultural preference for male births, higher-order female births are doubtless especially unwelcome.

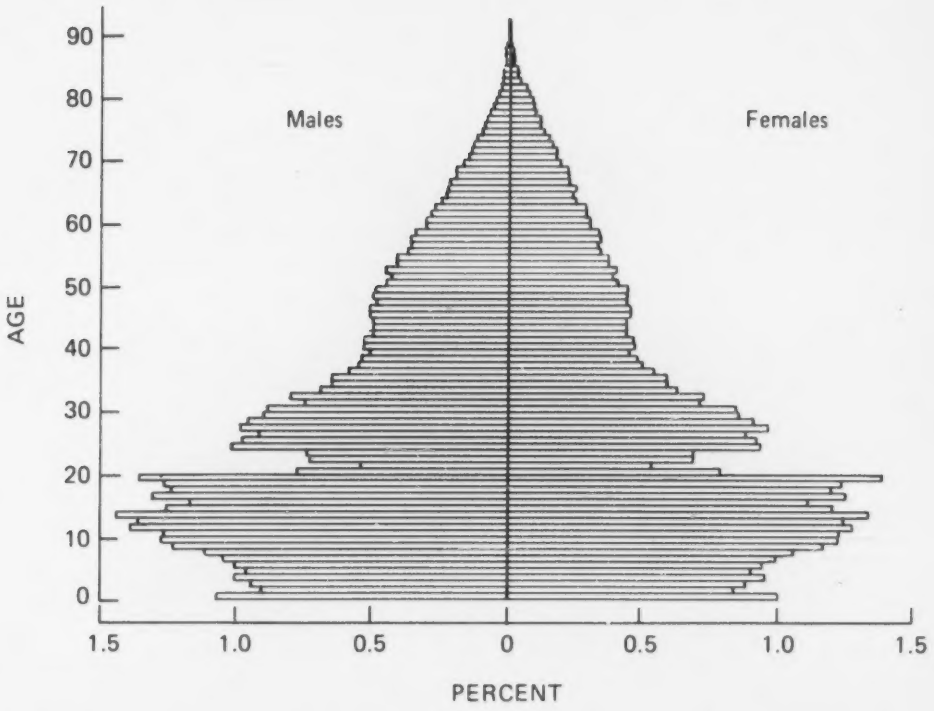


FIGURE 2 Age Pyramid of the Population, 1982: China

Source: China, Population Census Office (1983:Table 19).

Life Expectancy. Average death rates by age for each sex in each intercensal interval can be calculated from census data and constructed numbers of births. From these death rates life tables are derived that show the average age at death that would result from the continued prevalence of the calculated intercensal average death rates. The expectation of life at birth increased from 42 for males and 46 for females in 1953-64 to 62 for males and 63 for females in 1964-68. This increase in less than two decades replicates the increase typical of six West European populations from 1870 to 1940. A life table was recently calculated for 1981 from deaths reported in the 1982 census. It shows a further increase in expectation of life at birth to 66 years for males and 69 for females.

Mortality Rates. Official figures on the annual number of deaths understate the true number by a greater proportion than the proportionate understatement of the number of births. It is possible to determine only the

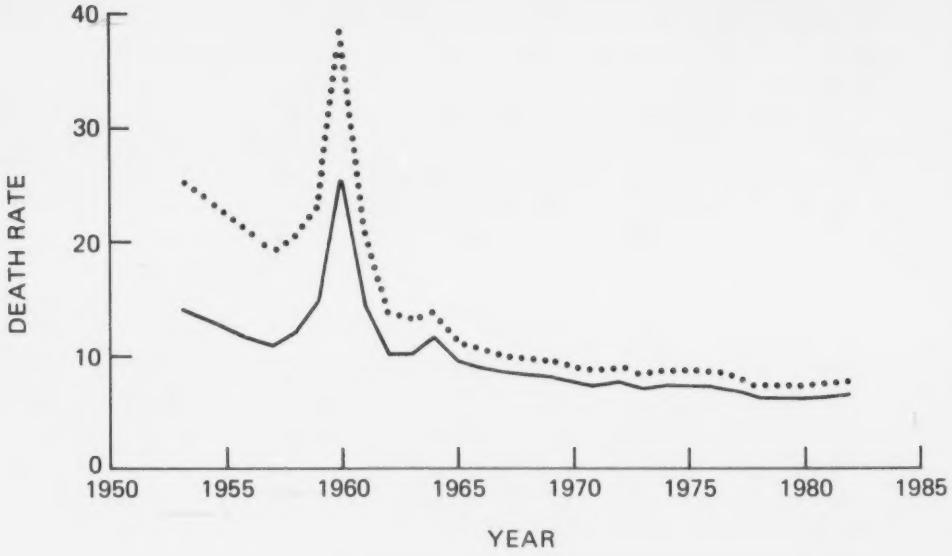


FIGURE 3 Death Rates (per 1,000) from Recorded Deaths (solid line) and Adjusted for Underreporting (dotted line), 1953-82: China

understatement of the total number of deaths for intercensal periods: about 38 percent of the deaths in 1953-64 were not recorded and about 16 percent of the deaths in 1964-82.

According to official sources, annual death rates (Figure 3) were about 15 per 1,000 in the early 1950s and declined to about 11 per 1,000 in 1957. There was an increase in death rates during the years of the Great Leap Forward and the ensuing crisis, with an officially listed peak rate of 25 per 1,000 in 1960. The death rate fell to 10 in 1963 as normal conditions were restored, then continued to decline to a rate between 6 and 7 per 1,000 in the late 1970s and early 1980s. When the intercensal aggregate shortfall in the number of deaths derived from official sources is allocated under an assumption of improving completeness after 1955 and constant completeness from 1964-82, the estimated death rate in the early 1950s is above 20, the peak death rate in 1960 is above 35, and the recent death rate is between 7 and 8 (rather than between 6 and 7). Excess deaths (those above a linear trend) from 1958-63 are about 16 million when based on the understated official figures and about 27 million when adjusted for understatement.

CHAPTER 1

INTRODUCTION

SCOPE OF THE REPORT

This report is a summary of fertility, nuptiality, and mortality in the People's Republic of China from the early 1950s to 1982. It is based largely on the single-year age distributions tabulated in the censuses of 1953, 1964, and 1982 (with some adjustment) and the detailed history of fertility and nuptiality collected in the large-scale 1982 survey of retrospective experience among 311,000 women aged 15-67. The survey was conducted by the State Family Planning Commission.

Much of the data presented here are taken from a special issue of the Chinese journal Population and Economics, published in 1983, which was devoted to detailed information about the fertility survey and its results. Some of the important features of the demography of China summarized in this report--such as the sequence of total fertility rates for each year since 1950--are simply reproduced from Chinese sources (in particular the special issue of Population and Economics). Other features, such as birth rates, completeness of official data on annual births and deaths, marital fertility rates by age and by duration of marriage, and intercensal life tables, were calculated for this report. The methods of calculation range from simple cumulation of fertility rates to newly invented methods of life-table construction from census data.

The report is intended as a summary of population trends and not as an account of their causes. It presents some treatment of what demographers call the proximate determinants of fertility, including an analysis of the influence of changes in nuptiality on fertility and inferences from the age structure of

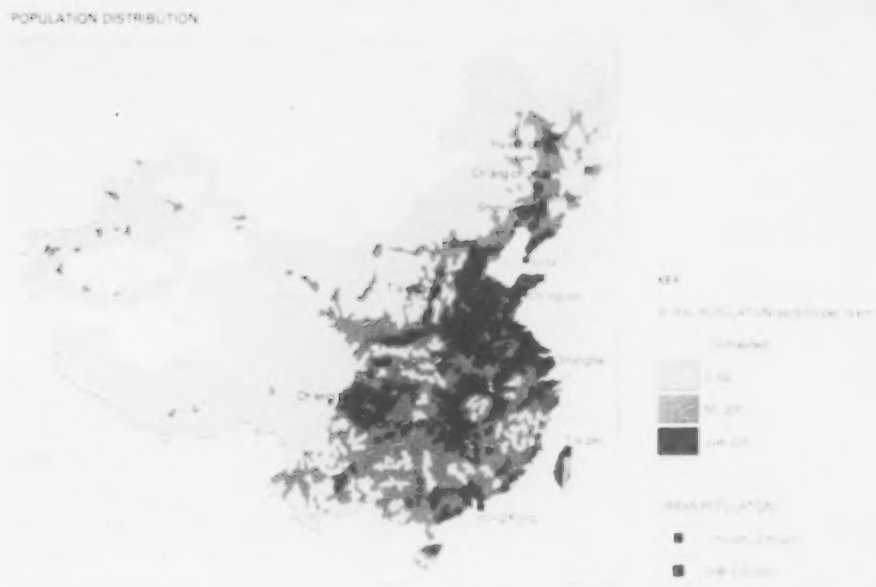
marital fertility about the probable absence or prevalence of contraceptive practice. It also comments on the most conspicuous features in the evolution of the population: the deficit of births and the excess of deaths in 1958-61 and the steep decline in fertility after 1970. However, the aim of the report remains demographic, to describe and analyze the population patterns in China.

BACKGROUND

With a population of just over 1 billion, China is the most populous country in the world. Its population is one-third larger than the second most populous country, India (with about 725 million in 1984). In area, however, China ranks only third; with 3.69 million square miles, it has almost exactly the same area as the United States, with 3.62 million square miles. China is geographically similar to the United States in other ways, too: its territory extends 3,100 miles from east to west, although its north-south distance of 3,500 miles is much greater than that of the United States. China also has extensive mountainous terrain and arid and semi-arid areas. In addition, the population of China, like that of the United States, is concentrated in the eastern part of the country (see map).

Located in East Asia, China has very long boundaries (17,445 miles), which include long borders with the Soviet Union and the Mongolian People's Republic to the north and northwest, borders with India, Pakistan, and Afghanistan for the most part to the west, and with the Socialist Republic of Vietnam to the south. A cross-section of the country would show a land mass lying at low altitudes in the east, rising to plateaus, and on to the mountains in the west, including the world's tallest, Mt. Everest at 28,911 feet. China's main lowlands, which include the Manchurian Plain, the North China Plain, the Middle and Lower Yangtse River, and the Southeastern Hills, cover about 386,000 square miles (Kaplan et al., 1980). These plains in the eastern and southeastern parts of the country contain large parts of the Chinese population. Through these plains flow some of China's major rivers, including Asia's longest, the 4,000-mile Yangtse, in central China and the 3,000-mile Yellow River in the north.

Despite a substantial expansion of China's urban population during the early twentieth century, the



Source: Hook (1982:40).

country is still primarily rural; some four-fifths of the Chinese population reside in rural areas. The largest cities are Shanghai, on the southeastern coast, and Beijing, the capital, with 6.3 and 5.5 million inhabitants, respectively. Including the rural populations of the administrative districts, Shanghai has almost 12 million people and Beijing a little more than 9 million. The largest province is Sichuan, in the south, with more than 100 million people; thus, like Uttar Pradesh in India, if Sichuan Province were an independent nation, it would rank among the world's 10 most populous countries. Overall, China is divided into 22 provinces, 5 autonomous regions, and 3 municipalities.

Some 94 percent of the population of China consists of ethnic Chinese, known as Han (Kaplan et al., 1980). However, China is not unified linguistically: within the Chinese language, many mutually incomprehensible dialects

are spoken, although the written Chinese language is uniform and can be understood by all. There are also a number of non-Chinese languages. The official spoken language of the People's Republic of China is "putonghua," meaning "standard speech," which is based on the northern Chinese dialect and is sometimes referred to in the West as Mandarin. China's 54 national minorities--60 million people-- live scattered across the half of China's land mass that they occupy. Speaking a variety of languages, they are encouraged by the authorities to maintain if not strengthen their cultural and linguistic identities.

CHAPTER 2

SOURCES AND QUALITY OF DATA

DATA SOURCES

The People's Republic of China had an enumerated total population in 1982 of more than 1 billion persons. The population has experienced dramatic recent reductions in birth and death rates, apparently surpassing the changes in any other very large less-developed country. These general features of the Chinese population had until recently been revealed in scattered information, such as travelers' reports, short news dispatches, and occasional sketchy official releases. Since the late 1970s, however, information on the population of China has been enriched by the sudden availability of a treasure of detailed demographic data--data relating both to the recent past and to the early years of the People's Republic.

Census and Fertility Survey Data

The 1982 Census and the 1982 Fertility Survey. The major sources of detailed information are two large data collection efforts that took place in 1982. The first of these was the 1982 census of population in which a field staff of 5.1 million enumerators counted a total of 1.008 billion people. The second effort was a sample survey conducted by the State Family Planning Commission, also in 1982. This survey obtained information about the complete childbearing and marriage histories of a sample of women aged 15-67. The households included in the survey had a population totalling more than 1 million. The survey included data on contraceptive practice, education, occupation, ethnicity, recent abortions, and possession of a one-child certificate.

The results were published (in Chinese) in a 176-page special issue of the journal Population and Economics.

Data from the 1953 and 1964 Censuses. The first modern census of China was conducted in 1953. Very limited results, such as the total population, were revealed in 1954, although fundamental details, such as numbers of persons classified by age and sex, remained unavailable outside of China. A second census took place in 1964; the mere fact that it occurred was not generally known until some years later, and again no details were released. Within the past two years, however, the most essential demographic information--the number of persons of each sex classified by single years of age--from these two censuses has been published. The Ministry of Statistics has also recently published the Statistical Yearbook for 1983 with hundreds of tables, including annual birth and death rates since 1950.

It is now possible to piece together from the newly available information the history of the population of the People's Republic of China from 1950 to 1982 with much more accuracy and more detail than has been possible until now. Indeed, as the following pages show, the accuracy and fineness of detail of the information about the Chinese population now exceed the accuracy and detail of what is known about almost every other less-developed country in the world.

Independence of the Data Sources

The various quantitative comparisons presented in the following pages convey a very surprising degree of consistency among numbers derived from the censuses of 1953, 1964, and 1982 and from the large-scale fertility survey. Some demographers and statisticians have suggested that the consistency of the data results from a lack of independence of the sources and is not convincing evidence of accuracy of the data. This possibility arises because China has a nationwide, comprehensive registration system. Each community maintains a register of the population in which there is a listing of the de jure population, to which an addition is made for each birth and legal in-migrant and a deletion is made for each death and legal out-migrant. The registration system also includes the maintenance of a household book

containing a listing of the de jure members of each household. The 1982 census involved a preliminary nationwide updating of the registers in each community, and the registers and the household books played a part in the census itself. The fertility survey, which was conducted about 2 months after the census, used the census as the frame for its 1/1,000 sample and checked the roster of each household included in the sample against the census listing. The hypothesis that consistency may not imply accuracy derives from the possibility that the censuses (and perhaps the survey) were simply readings of the registers. If so, the mechanics of maintaining a register would guarantee that persons listed in 1964 and still alive in 1982 have a consistent age and that, on a national level (with inconsequential international migration), the change in the number listed in a cohort must be consistent with the deletions made as a result of recorded deaths. If the number of children born to a given woman is copied from the register, the number recorded in the 1982 census and the number listed in the sample survey might be the same without being correct.

There are two reasons for rejecting the hypothesis that consistency may not imply accuracy. The first is that the procedures followed in the 1982 census and survey, as published, involved much more than checking the registers. For the census, there was extensive preparation, pretesting, and postenumerative checking along with the actual census. It is also of note that the census was conducted with substantial technical and financial assistance from the United Nations. The census was closely tied to the registers, but only after extensive updating and verification; individual data were verified by the person in question. For the 1/1,000-sample fertility survey, the published descriptions of the procedures specified face-to-face interviews for the detailed marriage and fertility histories.

The second reason for rejecting the hypothesis is that the annual numbers of births derived from a combination of census-based estimates of numbers of women each year and survey-based retrospective data on fertility rates are quite different from official records of the annual number of birtns. In other words, the fertility histories are in wide disagreement with official data on births and so cannot have been derived from the registers.

Characteristics of the 1982 Census and Fertility Survey

Procedures of the 1982 Census. Li Chengrui, the director of the State Statistical Bureau and head of the National Population Census Office, has described the procedures of the 1982 census in detail (Li 1983a and 1983b). The procedures included pretests of the census in successive stages, beginning with a pretest conducted by the central government and extending to pretests in each of China's 2,741 counties, covering a total of more than 25 million people. In addition, the register of the population was updated before the census. Li summarizes these procedures (1983a:337):

> First, from the beginning of 1981 through March 1982, household registration was updated. In a sense, this amounted to a precensus check. During this period, more than 5.7 million household registration personnel, statistical personnel, and other basic-level cadres were mobilized to update household registration throughout the country. They conducted a systematic investigation through household interviews and found and corrected errors: 6.1 double registrations per thousand and 5.4 omissions per thousand. Second, prior to the formal enumeration on 1 July 1982, the enumerators arrived at their census districts and conducted a further investigation. They checked household by household for the "five types of persons" identified in the "Census statute" manual. During this procedure, further errors were found and corrected. Based on the information from a subset of areas, double registrations were found to amount to 3 per thousand population and omissions to 2.5 per thousand. Third, after the conclusion of the census enumeration, 10-20 days were spent rechecking household by household and person by person all the census questionnaires. Some errors were again found and corrected. Based on the information from a subset of areas, during the recheck, double countings of 0.1 per thousand and omissions of 0.2 per thousand were found and corrected.

Following these precensus and census procedures, there was a post-enumeration survey (Li, 1983a:338):

> . . . the population census offices of the provinces, municipalities, and autonomous regions first selected, by multistage random sampling, 972 production teams and resident groups (a total of 187,362 persons according to the census) as the survey units. The provincial, prefectural, and county-level offices then selected persons who were of higher educational level and were conscientious and responsible in their work to undergo special training to become sample enumerators. They conducted the postenumeration survey in the selected sample units household by household and then compared the figures obtained with the figures of the original census enumeration. When errors were found, a second check was made before the data were corrected. Based on the stipulations, the census personnel who originally carried out the census enumeration in these production teams and resident groups were not selected as sample survey enumerators . . . . The sample check mentioned above shows a net overcount of 0.15 per thousand.

On the specific issue of the dependence of the census on the register, Li writes that the census included (1983a:339-340):

1. De jure population: 990,658,313

2. Persons who lived in the local area for more than one year but whose residence is registered elsewhere: 6,364,518

3. Persons who have lived less than one year in the locality but have left their place of registered residence for more than one year: 210,322

4. Persons who are living in the locality but whose residence registration is still pending: 4,754,602

5. Persons who originally lived in the locality but are working or studying abroad and have no residence registration: 56,930

> The population of types 2 through 5 totals 11,386,372. These are persons who are not included in the local household registration books. The 4.75 million persons whose household registration is still pending have not been omitted from the census enumeration. They are listed as the fourth type and are included in the census population total. The figures given above are sufficient evidence that the population census is absolutely not a repetition of the household registration.

Features of the 1982 Fertility Survey. The large-scale survey of fertility conducted by the State Family Planning Commission in September 1982 (described in Xiao, 1983), had a reference date of July 1, the same date as the census. The sample frame was the census listing itself. It was a stratified self-weighting cluster sample, covering all households in 815 areas: 732 rural production brigades and 83 urban residents' committees. The total population in the survey was a little more than 1 million, involving a sampling fraction of about 1/1,000. The choice of such a very large sample size was based on the calculated number of respondents required to yield 95 percent confidence limits for the peak single-year age-specific fertility rates that would differ by only 5 percent from the rate calculated from the sample, after allowance for the greater variance in a cluster sample than in a simple random sample.[1] Because the sample was so large, estimates of age-specific fertility rates and rates of first marriage by single years of age extending back into the 1950s have remarkably low sampling variability. The estimated annual total number of births in China (and the associated crude birth rates and total fertility rates) are derived from the reported numbers of births in the sample, which range from about 15,000 for each year in the 1950s to more than 20,000 for 1981. The sampling standard deviation of such large numbers is no more than about 1 percent.

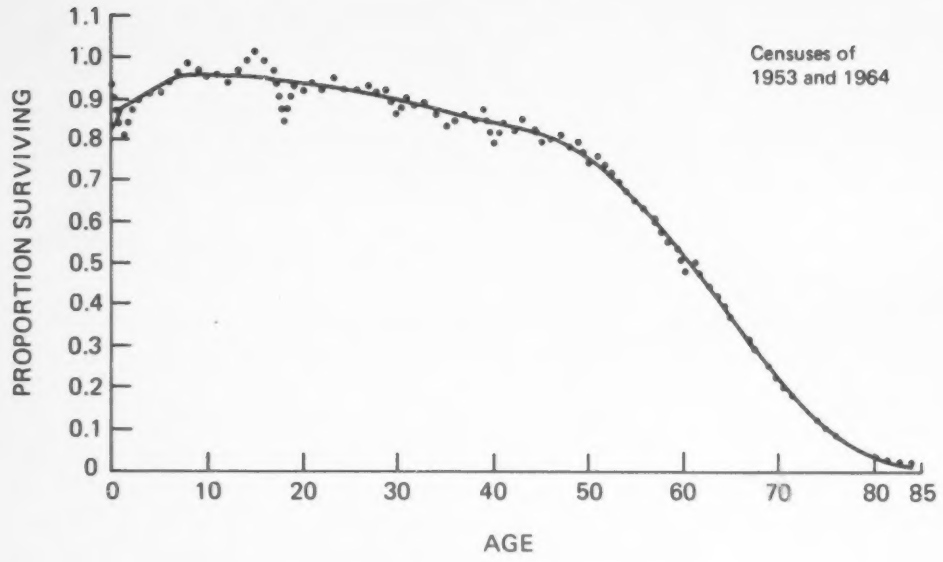
The survey had two parts, the survey of the de jure population to establish the composition of the households included in the sample and the detailed survey encompassing a variety of information about "qualified women"--all women aged 15-67. Data on the de jure population was copied from the results of the census, with verification of changes that might have taken place since July 1 using sources in the local areas (presumably the registers plus

local informants). But great emphasis was put on the requirement that the survey of qualified women should be conducted by face-to-face interviews. The instructions on obtaining information in these interviews were explicit and detailed. They included specifications that all ages shall be entered in completed years and all dates in the solar calendar. An explanation of the relations among animal symbols, Chinese ages, solar ages in completed years, and solar and lunar calendars was included.

QUALITY OF DATA

Data By Single Years of Age

Consistency of the Census Age Distributions. Figure 4 shows the proportion of women surviving from one census to the next classified by single years of age at the earlier census: the survival ratios are for 1953 to 1964 and 1964 to 1982. Also shown in Figure 4 are survival ratios extracted from a life table expressing the proportion that would survive from birth to each age in a hypothetical cohort subject to the average mortality rate at each age for the intercensal interval.[2] The surprising feature of the single-year survival ratios calculated directly from the censuses is that there is so little irregularity. In most censuses the reported age distribution is distorted by what demographers call age-heaping, a tendency for too many persons to be reported at ages that respondents favor (usually ages ending in 0 or 5). However, because most intercensal intervals are either 5 or 10 years, the effect of age-heaping on survival ratios is usually dampened because preferred ages (e.g., 30 and 40) are in both numerator and denominator of the ratios. In China the intercensal intervals are 11 years and 18 years, but the survival ratios show almost no effect of age-heaping: from 1953 to 1964 the survival ratios for women aged 30, 35, 40, 45, 50, and 60 in 1953 are slightly too low (a favored age is in the denominator) and ratios at 29, 39, and 49 are slightly too high (a favored age is in the numerator), but the effect is very small. The high survival ratio from age 0 in 1953 to age 11 in 1964 is almost certainly the result of an undercount of infants under age 1 in 1953, possibly caused by age misstatement that inflates the number at age 1, leading to too low a survival ratio for this cohort. Other defects in the data are indicated



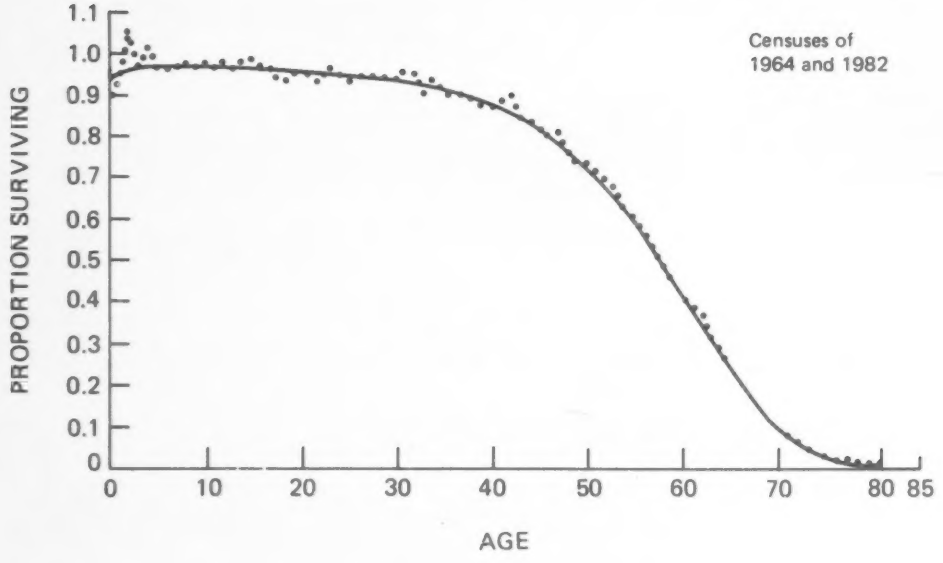


FIGURE 4 Proportion of Females Surviving Between Successive Censuses for Each Age (solid line is proportion derived from intercensal life table, dotted line is ratio taken directly from the census enumerations): China

by survival ratios above 1.0 at ages 2 and 4 in 1964-82 and at age 15 in 1953-64.

The limited fluctuations in the survival ratios indicate highly uniform completeness of coverage by age and extremely limited age misreporting. That very accurate information about age can be obtained from a Chinese population is well known. The reason is a cultural one. People of East Asian culture (Chinese, Japanese, Korean, etc.) almost universally know their date of birth, even when illiterate, usually in terms of the animal year of birth (in a cycle of 12 animals and 5 different qualities for each animal, a complete cycle that repeats every 60 years) and the lunar month. Because of this knowledge, if age is determined through a question asking the date of birth, followed by use of a formula that converts the animal year and lunar month to a Western date, age can be determined with precision. Evidently, such a procedure was used in all three censuses.

Consistency of Census and Fertility Survey Data. The data collected and tabulated from the large-scale fertility survey conducted by the Ministry of Family Planning in 1982 are even more remarkable than the census data in their internal consistency. The published tables include rates of childbearing by single years of age and single calendar years for women aged 15-49 for the years from 1950 to 1981. Analogous rates of first marriage by age are also included in the publication. These rates are derived directly from the births and marriages reported in the survey; because the dates of events are accurately reported, the age of each woman at the time of marriage and of each birth is readily determined.

The listing of birth rates by age of woman makes it possible to construct an annual series of the total number of births in China for each calendar year from 1950 to 1981. In order to construct that series, the number of women by single years of age from 15 to 50 in each calendar year is calculated by interpolating between the number in each cohort recorded in two censuses. That is, one can determine with good precision (on the assumption that the censuses are accurate) the number of persons at age 15 in 1954 by subtracting from the number 14 in 1953 one-eleventh of the decrease in this cohort between its enumeration in 1953 at age 11 and its enumeration in 1964 at age 25.[3] The number of births that occurred in each year is then calculated by

multiplying the number of women at each age (determined through cohort interpolation of census data) by the age-specific rate of childbearing taken from the fertility survey and summing these births for all women aged 15-49. (The number of women classified by single years of age from 15-49 in each year appears in Table A-1. Tables that contain primarily raw data or large sets of calculated data are included in the appendix.) The numbers of births so calculated from 1951 to 1981 permit a sensitive test of the consistency of the fertility rates from the survey with the data on age distribution in the censuses of 1964 and 1982. For example, the number of persons at age 5 (i.e., between exact age 5.0 and exact age 6.0) in 1964 must equal the number born between July 1, 1958, and July 1, 1959, multiplied by the proportion who survived from birth to age 5.[4] The number of persons aged 23 in 1982 must equal the number at 5 in 1964 in this cohort multiplied by the proportion who survived from 1964 to 1982. Appropriate survival rates have been extracted from intercensal life tables derived from the censuses and the estimated numbers of births.

In short, there are two sets of numbers for the population classified by single years of age from 0 to 11 in 1964 and from 0 to 29 in 1982. One set is taken from the census and the other from estimated births and survival rates from the survey--the births calculated from retrospective fertility rates combined with interpolated numbers of women and the survival rates from intercensal life tables. In Figure 5 the two sets of numbers are compared. The agreement is extraordinary, especially since the reallocation of births from calendar year to fiscal year is necessarily only approximate and would be so even if the number of calendar-year births were exact.

Abnormal Ratios of Men to Women in Census and Survey Data

Omission of Males from the Census Age Distributions. A systematic deficiency in the reported age and sex distributions in the Chinese censuses becomes evident when the ratio of men to women at each age is plotted. Such plots are shown in Figures 6 and 7. In each census it is apparent that the number of males in the young adult span--from 16 to 40 in 1953, from 16 to 24 in 1964, and from 16 to 23 in 1982--is too low, because of the

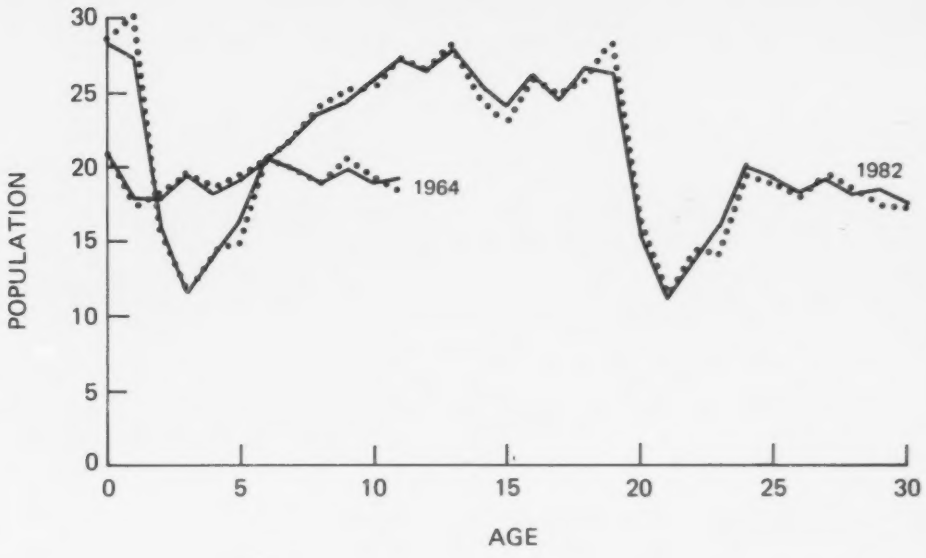


FIGURE 5 Number of Persons Under Age 30 in 1982 and Number of Persons Under Age 11 in 1964 (in millions) by Single Years of Age, as Projected (solid line) and as Enumerated in the Census (dotted line): China

omission of males, mostly those who are in the army. The 1982 census lists the number of males and females in the army, although without giving their ages. The number in the army is 4.2 million, of whom 109,000 are female. In 1953 the news release that reported the conduct of the census gave a population of 574.2 million who were "directly enumerated," and an additional 8.4 million who were indirectly enumerated. The recently released single-year age distribution for 1953 totals only 567.4 million. The 6.8 million difference between the total for which an age distribution is released and the total that was directly enumerated may be taken as the number of persons in military service. Ostensibly the 1964 census included the army, but it is evident from the ratio of males to females in the ages of principal military service that a large number of males at these ages were omitted. In 1953 and 1982 an adjusted age distribution was constructed by allocating the known or estimated number of persons in the armed services age by age, using a rough estimate of the ratio of males to females at each age based on the ratio at ages prior to the range of military service and the ratio at ages above

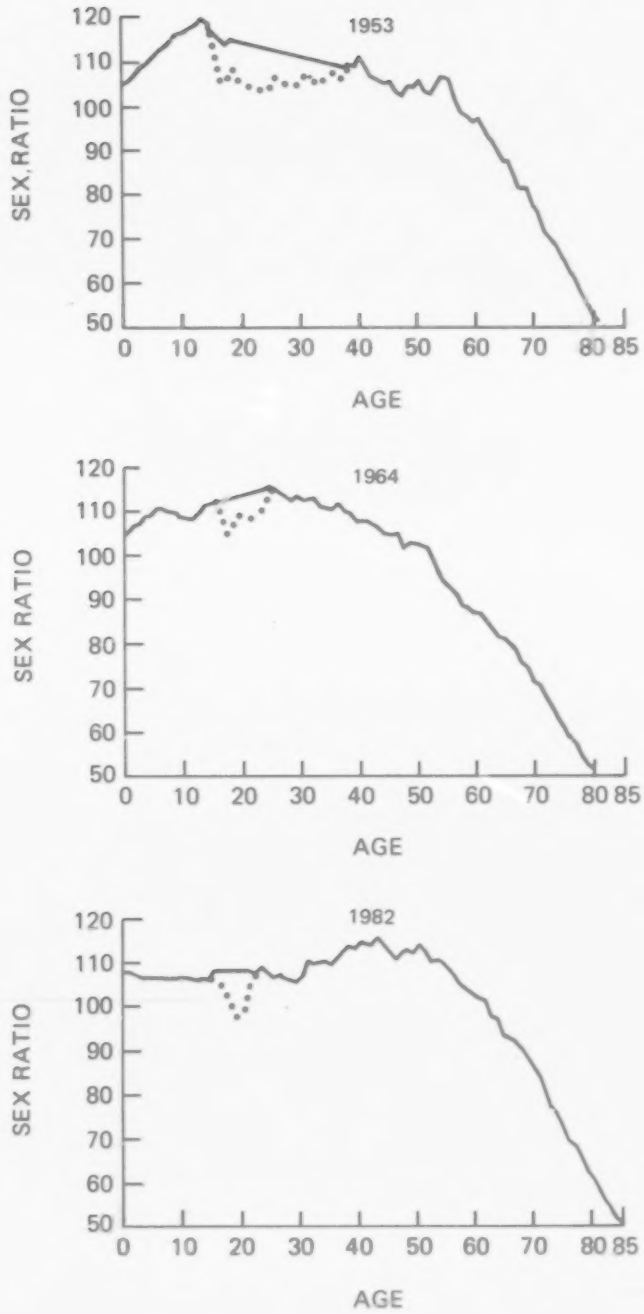


FIGURE 6 Sex Ratio (males per 100 females) by Single Years of Age (dotted line represents original data, solid line includes estimates of males in armed services), 1953, 1964, and 1982: China

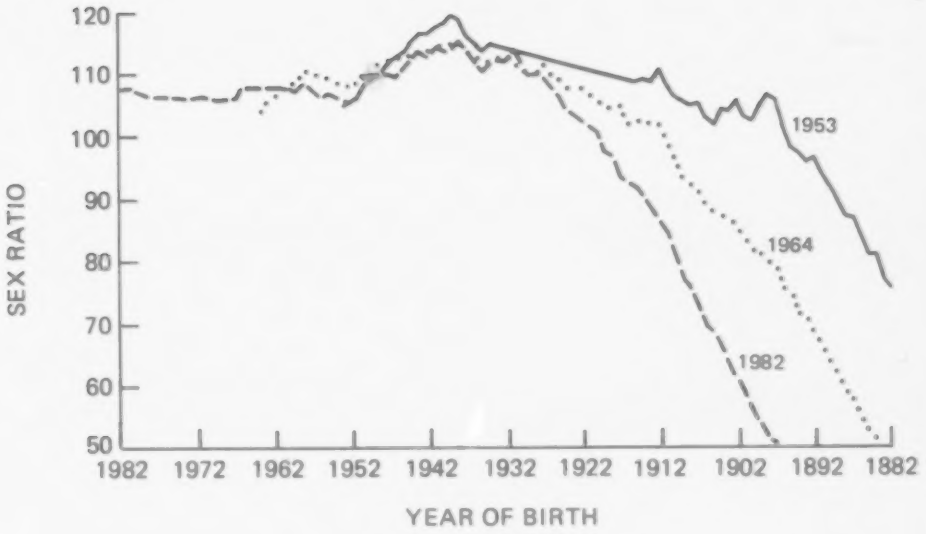


FIGURE 7 Sex Ratio (males per 100 females) by Year of Birth for Censuses of 1953, 1964, and 1982 (estimated number of males in armed services included): China

Note: Year of birth refers to 12 months calculated as of January 1 of given date.

this range. A similar procedure was used to add males at ages 16-23 in 1964, but without a listed total in the army from official data. (The adjusted age distributions are given in Table A-2.)

A remarkable feature of the male/female ratios in the three censuses is the increase in the ratio with age in all three censuses, from a moderate ratio for the cohorts born around 1951 to a ratio of 115 males or more per 100 females for those born in 1940, and the continued high ratio of males to females for cohorts born still earlier. The normal expectation in a population not gaining or losing significantly from migration is that the male/female ratio will be highest at birth (at about 106 males per 100 females) and decline more or less monotonically with age because of the general prevalence of higher male than female mortality rates. Such a declining male/female ratio occurs at the older ages in the Chinese censuses. The anomalous increase seen for the birth cohorts of 1951-52 back to the cohorts born about 1940 in all three censuses implies that those born

before about 1952 experienced higher female than male mortality, contrary to the usual greater viability of females. Another remarkable feature of the ratio of males to females is the precipitous drop in this ratio at older ages, especially the decline in the male/female between 1953 and 1964 for older cohorts. The decline in the proportion male within the same cohort by as much as 25 percent in 11 years suggests an extraordinary excess mortality for males.

Male/Female Ratios in the Fertility Survey. There are two anomalous features of the ratio of males to females in the 1/1,000-sample fertility survey. The first is that the ratio of males to females in the de jure population was 102.8 males per 100 females, compared to 106.8 for the census (Liu and Li, 1983). The standard deviation for the ratio in a sample of 1 million is about 2/1,000, so that the difference cannot be from sampling variation. The difference is mostly from ages 20 to 60; in each five-year age interval the male/female ratio in the census is at least three points higher--and as much as nine points higher at ages 35-39. In view of the consistencies of several kinds in the fertility histories (see below), it may be conjectured that less care was taken in establishing the de jure population of the households than in collecting the detailed marriage and fertility histories.

The second anomaly is puzzling information in a table that lists the number of male and female births in 1981 by sex and birth order in the rural and urban populations. The puzzle is an increase in the male/female ratio as birth order increases, in both rural and urban populations. In most populations the ratio of male to female births is about 1.06, and in well-recorded vital statistics there is only a slight difference in the male/female ratio of births at different birth orders--a difference in the direction of a very small reduction in the ratio as birth order rises. In the Chinese fertility survey the ratio of male to female births in the rural population is 1.046 for first births, 1.069 for second births, and 1.124 for births of third and higher order. In the urban population, the ratio is 1.085 for first births and 1.178 for births of second and higher order. (There were only 257 urban births above the first order reported for 1981.) The male/female ratio of 1.055 among rural births of first and second order in 1981 is very close to the normal ratio, but there is a marked increase in the ratio

with birth order--above first-order births in the urban population and above second- order births in the rural population. The reality of this increase can be challenged on the basis that it may be the effect of mere random variation in the male/female ratio when the number of births is small. The standard deviation of the ratio of male to female births caused by stochastic variation is approximately $2\sqrt{n}$ when n is the total number of births. Since there were only 257 urban births of second or higher order, the ratio of 1.178 for higher-order urban births differs by less than one standard deviation from a normal ratio of 1.06; the possibility that the high male/female ratio occurred by chance cannot in this instance be ruled out. However, the male/female ratio of 1.124 for rural births of third or higher order (there were 5,957 such births reported) is 2.47 standard deviations above 1.06. It is scarcely possible that the uniformly higher male/female of urban births and the regular increase in the ratio with birth order in both rural and urban births are the results of sampling quirks.

The relatively high male/female ratios in higher-order births might be the result of simple underreporting of higher-order females births in the survey. It is understandable that a higher-order birth that occurred contrary to the one-child campaign would be unregistered because the parents would want to conceal such a birth. Given the cultural preference for males, local officials might be sympathetic in registering a higher-order male birth and join in keeping unregistered a higher-order female birth. Comparison of births reported in the survey for 1981 and registered births shows that more than 3 million births in that year were not registered. It is possible that the much more complete reporting in the survey still omitted the births of surviving female children.[5] Sex-selective abortion is not yet technologically feasible and certainly not in the rural areas. A possibility that remains is unreported sex-selective infanticide. Such a practice would likely be unreported in an official survey and might rise with birth order because of the increasing penalties accompanying higher-order births. There are many reports of female infanticide in the Chinese press; it is mentioned as a possible explanation of the high male/female ratio of the higher-order births by Liu and Li (1983).

Official Data on Births and Deaths

Official Figures of Annual Numbers of Births. As noted above, the age-specific fertility rates constructed from the fertility survey can be combined with the calculated number of females by single years of age to produce estimates of the annual number of births. The annual number of births so constructed can be compared with the annual number taken from official sources, presumably based on the number of births registered (see Table 1). The estimated number exceeds the official number with only one exception. The ratio of the official figures to the constructed figures is a valid estimate of the completeness of the official figures since the estimated figures are very consistent with the numbers counted at each age in the censuses. Completeness of official reporting in each year is shown in Figure 8, together with a three-year moving average of completeness.

The moving average is useful to show the general trend of completeness of recording, free of large year-to-year fluctuations. There are two likely reasons for the fluctuations. One reason is imperfect conversion of date of birth in the fertility survey to the western (solar) calendar if the year of birth was reported in the Chinese (lunar) calendar. According to the Chinese calendar, years of 12 lunar months are interspersed, irregularly, with years of 13 lunar months. If year of birth was reported according to the Chinese calendar, there would be too many births reported in the 13-month years and too few in the 12-month years. The result would be understated estimates of completeness of recording in 13-month years and overstated estimates in the other years. In Figure 8 the 13-month years are labeled; it is clear that too many births were reported in those years. The second reason for large year-to-year fluctuations in the sequence of estimated completeness of reporting births is a possible tendency to report births in the year following their occurrence. An unusually large degree of delayed reporting might reduce estimated completeness in one year and increase it in the next. The most puzzling estimate of completeness of reporting is the high estimate for 1967 (more than 1.0 before correction for the effect of the use of a lunar calendar). There may be some connection between this anomaly and the disruption that resulted from the Cultural Revolution, which had just begun.

TABLE 1 Annual Number of Births (in millions) from Official Figures and as Calculated from Fertility Rates in Survey and Interpolated Populations, and Estimated Completeness of Reporting, 1953-82: China

Year	Number of Births		Completeness of Reporting
	Official	Calculated	
1953	21.51	24.54	.877
1954	22.45	25.76	.877
1955	19.79	25.94	.763
1956	19.76	29.45	.808
1957	21.67	27.13	.799
1958	19.05	24.16	.788
1959	16.47	18.48	.892
1960	13.89	17.38	.799
1961	11.88	14.52	.818
1962	24.60	26.78	.918
1963	29.54	33.53	.881
1964	27.29	28.01	.974
1965	27.09	27.94	.968
1966	25.77	29.28	.880
1967	25.63	25.35	1.011
1968	27.57	31.48	.878
1969	27.15	28.68	.947
1970	27.36	29.98	.913
1971	25.67	29.07	.883
1972	25.66	27.49	.933
1973	24.63	26.14	.942
1974	22.35	25.26	.885
1975	21.04	22.70	.927
1976	18.54	21.64	.857
1977	17.87	19.97	.894
1978	17.45	19.96	.873
1979	17.27	20.95	.824
1980	17.99	17.74	.844
1981	17.46	21.05	.830
1982	(21.26)	(21.56)	

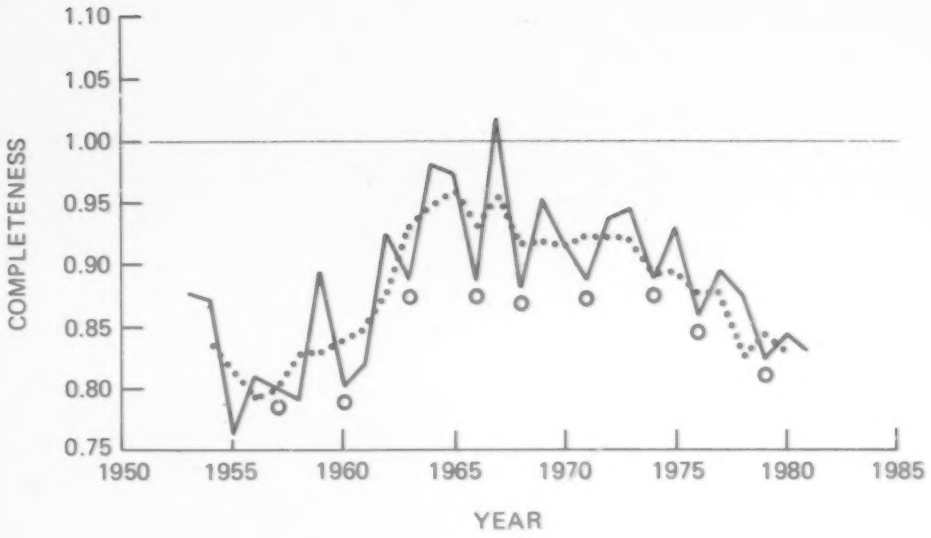


FIGURE 8 Completeness of Recording of Births (dotted line is 3-year moving average), 1953-81: China

Note: Circles designate years with 13 lunar months.

The moving average of completeness rises from about 80 percent in the mid-1950s to above 90 percent from 1963 to 1974; there is a decrease in completeness to less than 85 percent for years in the late 1970s. The official pressure for restriction of the number of births probably led to incomplete recording in those later years, both by parents fearful of penalties and by officials eager to meet targets.

Official Records of Death Rates. The completeness of death registration for each intercensal period as a whole can be estimated on the basis of the total population recorded in each census and the total number of births found to occur in each intercensal period. The difference between the total number of births between two censuses and the intercensal growth in population is the total number of deaths in that interval. The figure used for 1953 in these calculations includes the 8.4 million officially reported as indirectly enumerated; the 1964 figure includes an estimated 2.35 million young males omitted from the census, an estimate obtained by correcting understated ratios of males to females from age

16 to age 24; and the 1982 figure includes the official number in the armed service, whose ages were not reported. The number of deaths calculated in this way can be compared with the number implied by official figures for the population each year and with the annual death rate (State Statistical Bureau, 1983b). The calculations are as follows:

	Period	
	1953-64	1964-82
Calculated Births (millions)	265.4	448.6
Intercensal Increase in Population (millions)	114.3	311.3
Calculated Deaths (millions)	151.1	137.3
Official Number of Deaths (millions)	93.7	115.8
Completion of Recording of Deaths (percent)	0.620	0.843

The aggregate completeness of recording of deaths is 62.0 percent for 1953-64, and 84.3 percent for 1964-82. The degree of understatement, especially in the earlier period, is surprising, but it is hard to see how the omission of deaths could in fact have been much less. The consistency between the calculated annual births and the census enumerations by age was noted earlier; besides, it seems unlikely that respondents in the fertility survey overstated the number of births that had occurred to them. This possibility is especially remote because of the extraordinary agreement (mostly within 1 percent) between the number of children ever born by five-year age intervals constructed from the survey and the number reported by women in the same intervals in the 1982 census. The annual number of births estimated for the intercensal years incorporates the census populations as the source of the estimated number of women at each childbearing age, so that the birth estimates are

necessarily consistent with the increasing population from one census to the next (if the fertility rates are correct). The other possible source of an overestimate of the omission of deaths in the official data is understatement of the intercensal increase in population--an understatement that would imply that the earlier census was a more complete count than the later one, which is unlikely.

Comparison of the total number of registered births with the estimated total for the same intercensal periods leads to an estimate of average completeness of birth registration of 84.2 percent in 1953-64 and 91.2 percent in 1964-82. If a large fraction of the omitted births were births soon followed by an infant death that also went unrecorded, much of the estimated underrecording of deaths would be accounted for. The estimated number of unrecorded births in 1953-64 is 41.9 million, and the estimated number of unrecorded deaths is 57.4 million; the corresponding numbers for 1963-82 are 40.4 million unrecorded births, and 21.5 million unrecorded deaths.

These calculations are sensitive to the relative completeness of enumeration in the census. For example, if the 1964 census was undercounted by 2 percent more than the other two censuses, the calculated intercensal births would be increased by about 1 percent, the 1953-64 increase in population would be augmented by 13.9 million, and the 1964-82 increase would be diminished by the same amount. The estimated completeness of death recording would then be 67 percent for 1953-64 and 74 percent for 1964-82.

In the analysis of mortality in Chapter 5, three other sources of data are used for comparative purposes. One is an epidemiological survey conducted throughout China in 1973-75 in which deaths by age and sex and an age distribution of the population were recorded; the second is another large-scale survey in 1978 covering a sample population of over 100 million, reported in System Engineering and Science Management (Beijing) February, 1980, and the third is a life table constructed from the deaths in 1981 recorded in the 1982 census.

Data on Children and Marriage

Consistency of Survey and Census Data on Number of Children Ever Born. In addition to the consistency test described above ("Consistency of Census and Fertility

Survey Data"), a second test of the consistency of the age-specific fertility rates derived from the fertility survey and the 1982 census provides further evidence of very precise data. The age-specific fertility rates presented in the report of the survey for calendar years of time are converted into estimated fertility rates for fiscal years (July 1 to June 30) by a simple arithmetic average of the rates in two consecutive years. The rate of childbearing for women aged 15 in 1977-78, plus the rate of those aged 16 in 1978-79, plus the rate of those aged 17 in 1979-80, plus the rate of those aged 18 in 1980-81, plus the rate of those aged 19 in 1981-82 equals the average number of children ever born to women reaching exact age 20 in the middle of 1982.[6] By an analogous summation the estimated number of children ever born to women of each exact age from 16 to 65 can be ascertained. Then the average number of lifetime births of women at conventional single-year age intervals (15-16, 16-17, etc.) can be obtained by averaging (but using the geometric mean for the number born to women below age 20, to allow for the nonlinearity of the increasing number of children ever born at the youngest ages). Finally, the average number of children ever born to women at age 15 can be multiplied by the number of 15-year-olds in the 1982 census; the sum of such products for ages 15 through 19 yields the total number of children ever born to women aged 15-19. In Table 2 the total number of children ever born to women by five-year age intervals from ages 15-19 to 55-59 as constructed by this procedure is compared with the total number of children ever born reported by women in these age intervals in the 1982 census. The degree of consistency is remarkable: at 15-19 and 20-24 the constructed number of children ever born is within 2 percent of the census number; above age 25 for every age interval the agreement is within 1 percent.

Consistency Between Survival Rates of Cohorts and Proportion of Children Ever Born Reported as Surviving. William Brass was the originator of a widely used system for estimating child mortality from the fraction of children reported as surviving among the children ever born to women at different ages (Brass, 1968; United Nations 1983). One estimates the fraction of births that occurred to women in each time interval before a census or survey and selects a mortality schedule (e.g., from model life tables) that would yield the reported

TABLE 2 Total Number of Children Ever Born to Women Classified in Five-Year Age Intervals, 1982: China

Age of Women	Number of Children Ever Born (millions): From 10 Percent Sample Tabulation of Census	Constructed from Age-Specific Fertility Rates in Survey	Ratio: Survey/Census
15-19	0.873	.859	.984
20-24	15.29	15.08	.986
25-29	71.27	71.51	1.003
30-34	96.68	96.66	1.000
35-39	97.36	96.92	.996
40-44	104.67	104.00	.994
45-49	119.54	118.62	.992
50-54	109.42	109.03	.996
55-59	90.79	90.81	1.000

proportion surviving, given the time distribution of the births. If c(a) is the proportion of the children ever born to women aged 25-29 who were born "a" years before the census or survey and p(a) is the fraction of these children surviving from birth to the census or survey date, then the overall proportion surviving, P, necessarily equals $\int_0^\omega c(a)p(a)da$, when ω is the time between the earliest birth and the census date. Brass' technique is to estimate c(a) from information about the fertility history of the women in question, and by trial and error (or the logical equivalent) to select a survival function, p(a), that is consistent with the reported proportion surviving among the children ever born to these women.

In the 10 percent sample tabulation of the 1982 census there are tables listing the number of children ever born alive, and the number of children surviving, for women classified in five-year age intervals from 15-19 to 55-59. For each age group of women the fraction of the children they have borne that were born in each year prior to the census can be determined from the age-specific fertility rates recorded in the fertility survey (which had the same effective date as the census). Consider women at exact age 20 in mid-1982: The births

they had at age 19 occurred in 1981-82, those they had at age 18 in 1980-81, at 17 in 1979-80, at 16 in 1978-79, and at 15 in 1977-78. From age-specific fertility rates, one can calculate the fraction of births to those women that occurred at specified single-year periods in the past. A similar calculation can be made for women at exact age 18 in 1982; an average of the fraction in each period for those aged exactly 18 and those aged exactly 19 is a robust estimate of the fraction born in each period to women who were 18-19. Combining such calculations for women aged 15-16, 16-17, 17-18, 18-19, and 19-20, one obtains an estimate of the fraction of the children born alive by women 15-19 whose birth occurred in 1981-82, the fraction whose birth occurred in 1980-81, etc. The proportional distribution of births by fiscal year before the censuses, calculated in this manner, is shown for each group of women from 15-19 to 50-54 in Table A-3.

The distributions in Table A-3 are single-year interval tabulations of the function c(a) that is combined with the proportion surviving, p(a), in the Brass equation: proportion surviving = $\int_0^{\omega} c(a)p(a)da$. It would be possible to try different cohort survival functions and choose which among a set of possible p(a) functions is consistent with the proportion surviving reported in the census. Instead, a value of p(a) for each birth cohort is taken from Table 3, in which the survival ratio from birth in a given year to enumeration in 1982 has been calculated as the ratio of $({}_1N_a)_{82}/B(82-a)$, where $({}_1N_a)_{82}$ is the number enumerated at age a to a + 1 in 1982, and B(82-a) is the number of fiscal-year births a years before mid-1982. The fiscal-year births are based, in turn, on interpolated populations of women of childbearing age and age-specific fertility rates for each year in the past from the fertility survey. In other words, instead of using the Brass equation to chose a p(a) function from some arbitrary set of such functions, the equation is used to calculate the proportion of children surviving among the children ever born to women in each five-year age interval. The determination of proportion surviving uses a c(a) for each age group of women derived from their fertility histories and a p(a) for each cohort derived from the census enumeration and estimated births. The result is a set of <u>constructed</u> proportions surviving (based primarily on the fertility histories from the survey) that can be compared with the proportions <u>reported</u> in the census. The comparison is shown in Table 4.

TABLE 3 Estimated Fiscal Year Births, 1951-52 to 1981-82, Number Recorded in Corresponding Cohort in 1982, and Proportion Surviving: China

Age in 1982	Year of Birth	Fiscal Year Births (millions)	Number in Census (millions)	Proportion Surviving
0-1	1981-82	21.71	20.81	.959
1-2	1980-81	18.93	17.38	.918
2-3	1979-80	19.06	18.27	.959
3-4	1978-79	20.87	19.62	.940
4-5	1977-78	19.63	18.63	.949
5-6	1976-77	20.67	19.42	.939
6-7	1975-76	22.07	20.42	.926
7-8	1974-75	24.00	21.78	.907
8-9	1973-74	25.86	24.03	.929
9-10	1972-73	26.73	25.09	.938
10-11	1971-72	28.33	25.22	.891
11-12	1970-71	29.88	27.33	.915
12-13	1969-70	29.09	26.50	.911
13-14	1968-69	30.68	28.24	.920
14-15	1967-68	28.28	24.52	.867
15-16	1966-67	26.72	22.74	.851
16-17	1965-66	28.10	25.97	.892
17-18	1964-65	27.11	24.78	.915
18-19	1963-64	31.61	25.78	.815
19-20	1962-63	32.38	28.59	.883
20-21	1961-62	19.46	16.59	.852
21-22	1960-61	14.28	11.20	.784
22-23	1959-60	17.57	14.51	.826
23-24	1958-59	21.08	14.29	.678
24-25	1957-58	26.69	19.45	.729
25-26	1956-57	25.97	18.89	.727
26-27	1955-56	24.88	17.92	.720
27-28	1954-55	26.20	19.67	.751
28-29	1953-54	25.00	18.62	.747
29-30	1952-53	25.52	17.49	.685
30-31	1951-52	24.44	17.36	.711

The agreement between constructed and reported proportions surviving is remarkably close for women aged 25-29 to 40-44. The deviation at the youngest age intervals (under age 25) is explained by the fact that survival of children is not independent of age of mother. The construction for women aged 15-19, for example, uses the estimated survival ratio for all births in 1981-82, 1980-81, and 1979-80; but in fact the infant

TABLE 4 Proportion of Children Surviving Among Children Ever Born Alive to Women Aged 15-19 to 50-54, 1982: China

Age of Woman	Constructed from Fertility Survey	Reported in Census
15-19	.949	.920
20-24	.944	.938
25-29	.940	.936
30-34	.927	.925
35-39	.903	.903
40-44	.876	.877
45-49	.826	.843
50-54	.764	.801

mortality rate among first births and among children born to very young women is higher than the general infant mortality rate. The deviation at ages 45-49 and 50-54 may be caused either by a slight overstatement of proportion surviving in the census reports by older women or by a slight overestimate of births in the early 1950s (for which the fertility rates of older women are not based on retrospective data because of the age limit of 67 years in the survey). Another possibility is that at higher ages differential mortality among mothers may have left respondents with relatively favorable mortality experience and with children who also had higher than average survival rates.

The basic agreement between reported and constructed proportions attests to the probable validity of the cohort survival ratios--not to the validity of individual ratios, but to the average survival of groups of cohorts. Individual survival ratios can be in error because the estimation of fiscal-year births involves an arbitrary element and because of slight deviations of the reported time of birth caused by incomplete adjustment from the lunar to the solar calendar.

Consistency of First-Marriage Rates and Marital Status Data. When the single-year rates of first marriage are cumulated for persons aged 15 in year t, 16 in t + 1, and 17 in t + 2, the resultant sum is the proportion of ever-married women at exact age 18 at the end (December

31) of year t + 2. By such cumulations the proportions of ever-married women at age a and a + 1 at the beginning and end of each year can be determined; the average of these four numbers is an estimate of the proportion of ever-married women in the middle of the year of those between ages a and a + 1.

The proportion of ever-married women aged 15-35 from 1950 to 1981 calculated in this way is shown in Table A-4, which also lists the proportion of ever-married women in 1982 as ascertained in the de jure listing of households. The series of constructed proportions in 1980 and 1981 are very similar through age 19 to the reported proportion in 1982; above age 20 the increase in proportion married from 1980 to 1981 and from 1981 to 1982 reflects the rise in first-marriage rates.

The proportion of ever-married women by age are tabulated at 15-19 and by single year of age from 20 to 29 in the 10 percent tabulation of the 1982 census. For women aged 22 to 29 the proportion ever-married in the survey differs by at most 0.005 from the proportion in the census, but for women aged 15-19 the proportion is 2 percent greater in the survey (.062 compared with .042), and at 20 and 21 the proportion ever married in the survey exceeds the proportion ever married in the census by 1.2 percent and 0.9 percent, respectively. In the survey the enumerators were instructed to include as married those for whom no marriage certificate had been issued but who were recognized as being married by the family and the society (Xiao, 1983). This explainable difference is further evidence that data for the census and survey were not simply copied from the same register.

Quality of Data: Summary

A number of results have emerged from this examination of the quality of Chinese population data. The most important is the good but not perfect accuracy of the fertility and marriage information collected in the large-scale fertility survey. The retrospective fertility data provide the basis for constructing an annual series of births and birth rates, which is an addition to the published total fertility rates. The number of births in this series exceeds the number of births listed in official sources by a substantial margin; the fertility data could not have been copied from registers. In fact, the synchronism of low points in the ratio (of the number of officially reported births

to the number of calculated births) with years containing 13 lunar months is evidence that the fertility histories were obtained from respondents. In addition, there is a slight systematic bias in the time sequence of total fertility rates--which are too high in years with 13 lunar months. Further evidence of the independence of the survey from the register (and the census) is found in the higher proportion of ever-married women in the survey than in the census at young ages, a natural result of instructions in the survey to include married persons whose marriages had not been registered.

The consistency of cumulative fertility in the survey with the number of children ever born in the census is so close that independence is hard to believe. Nevertheless, there is no doubt, given the explicit nature of the instructions, the overreporting of births in 13-month years, and the excess of births reported in the survey in comparison with the official reports, that the detailed fertility history was in fact obtained by interviews with the qualified respondents. The interviewers might have had access to the total number of children ever born that the respondent listed on the census and might have probed for an omitted birth when the total number reported was less than the census response. But if the detailed fertility history yielded one more birth than the census, the interviewer would have been unlikely to scratch one birth from the survey form and it would not have been impossible to add one to the census. Moreover, the latter would have an inconsequential effect on the census results since the survey was a 1/1,000 sample.

The congruence of the proportions dead among children ever born constructed from the calculated birth sequence and the proportions dead reported in the census is powerful evidence of the validity of the birth sequence. It supports, indeed, the approximately equal coverage of the 1964 and 1982 censuses since the constructed survival rates for children born to women aged 40-44 are heavily weighted by the births estimated around 1964. If the 1964 census had been undercounted relative to 1982, the number of births around 1964 would have been underestimated, the survival rates to 1982 would be too high, and the constructed proportion surviving for women aged 40-44 would exceed the reported proportion.

With some minor exceptions, then, the fertility and nuptiality information taken from the census and survey can be accepted as of high quality; as such, they provide the basis for a valid history of recent trends in China.

CHAPTER 3

MARRIAGE IN CHINA SINCE 1950

The 1/1,000-sample survey conducted in 1982 by the Ministry of Family Planning collected retrospective data on marriages as well as on births. The report of the survey includes tables listing rates of first marriage by single years of age (the number of first marriages in a single-year age interval relative to the number of women in the interval) for each calendar year from 1949 to 1981. It also provides the calculated mean age at first marriage and the total first marriage rate for each year from 1940 to 1982 (Zhao and Yu, 1983). The total first-marriage rate for a given year is the sum of the single-year age-specific rates of first marriage. It equals the proportion that would ever marry in a hypothetical cohort subject to the marriage rates of the year in question.

PROPORTION EVER-MARRIED WOMEN AND THE FIRST-MARRIAGE RATE

Actual cohorts of women in China achieve very close to 100 percent entry into marriage, as is evident in the proportion of women ever married by single years of age in 1982--more than 98 percent at ages 29 and 30 and more than 99 percent at every age over 30. The annual total rate of first marriage has nevertheless differed from unity in most years, often substantially. It reached a low of .74 in 1959, during the Great Leap Forward, a high of 1.19 in 1962, as the economy and society recovered from the Great Leap Forward and the "bitter years" of 1960-61; and fell again to .71 and .73 in 1965 and 1966, at the beginning of the Cultural Revolution (see Figure 9). The lowest point of .64 was reached in 1973, in the midst of a rapid rise in the mean age at first marriage. From

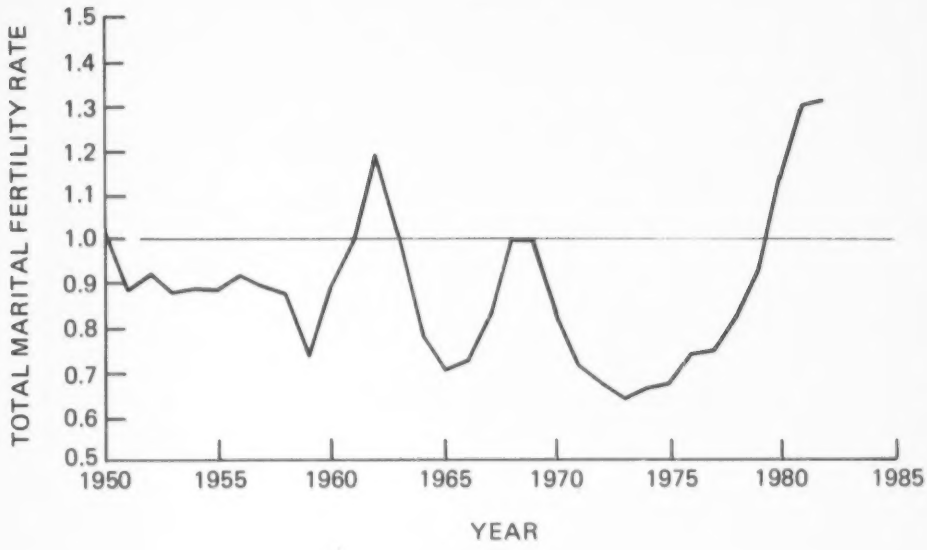


FIGURE 9 Total Female First-Marriage Rate (sum of first marriage frequencies), 1950-82: China

1971 to 1979, while mean age at first marriage was increasing from 20.29 to 23.05--an addition of almost one-third of a year each year--the total first-marriage rate was below 1.0 despite the ultimate achievement of nearly 100 percent ever married within each cohort. In 1980 the total first-marriage rate reached 1.14, higher than in any previous year except 1962; in 1981 and the first 6 months of 1982 it rose to a new high above 1.30, a boom in marriages that caused increased births in 1981 and 1982 and will have a continued upward effect on births in 1983.

There are two reasons for differences from unity in the annual total first-marriage rate even when every cohort experiences a proportion ever married very close to 100 percent. One reason is a temporary deficit in the number of marriages in years when social disruption prevents marriages that otherwise would occur and an excess in the number of marriages in the period of recovery from such episodes (for example, the deficit in 1959 and the excess in 1962). The second reason for high or low total rates of first marriage is a change in the mean age at which cohorts marry. When the mean age at marriage of a cohort falls, the total marriage rate rises above 1.0 because the marriages of older and younger

women, which would have occurred sequentially with constant mean age, overlap. The total rate continues higher than 1.0 as long as mean age at marriage continues to fall. A rising mean age at marriage has the opposite effect, thinning out the occurrence of marriage until the rise in mean age ceases. The average value of 0.885 of the total marriage rate from 1950 to 1982 (despite the continuation of virtually universal marriage) is the result of the increase in mean age at marriage of about 4 years during this time. According to a formula of Norman Ryder (1956), a period total first-marriage rate is reduced in proportion to the average annual rate of change of cohort age at marriage. An increase of 4 years in 32 years should reduce the average period total first-marriage rate by about 0.125, or to about 0.875--very close to the actual average value of 0.885 for the 32 years in question.

MEAN AGE AT FIRST MARRIAGE

Figure 10 shows the annual value of the mean age at first marriage from 1950 to the first half of 1982. The mean age at first marriage calculated for the decade of the 1940s is little different from the mean for 1950 (18.46 compared with 18.68), but was a year higher than the average (17.52) for the Chinese farm population in 1929-31 (Barclay et al., 1976). The increase in mean age was relatively gradual in the 1950s and 1960s and relatively rapid in the 1970s. The revolutionary government set a legal minimum marriage age of 18 years and introduced many changes in social organization that reduced the incidence of very early marriage. In 1953 nearly 43 percent of women were married before reaching 18; by 1965 this fraction had fallen to about 21 percent; at the beginning of 1982, only 4 percent had married before reaching 18.

The mean age at marriage rose sharply after 1970: in the 8 years from 1971 to 1979 the increase was twice what the increase had been in the 21 years from 1950 to 1971. The rise in age at marriage in the 1970s was certainly enhanced, if not altogether produced, by government pressure as part of the program to reduce the birth rate. The official policy was later marriage, longer birth intervals, and fewer children. Women were encouraged to postpone marriage until age 23 in the rural areas and until age 25 in the cities. From 1971 to 1979

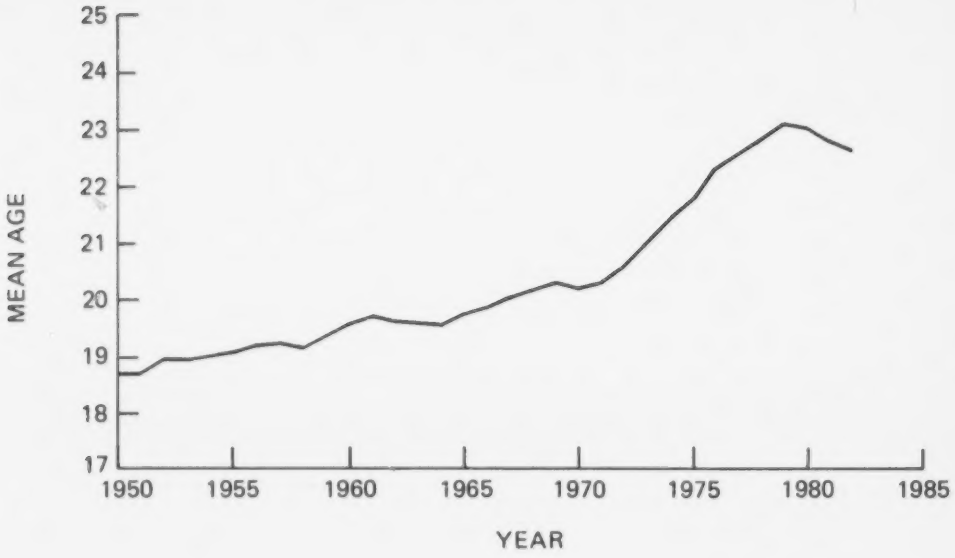


FIGURE 10 Mean Age at First Marriage of Females, 1950-82: China

the reduction in the proportion of women who had ever married before reaching age 24 was large in the rural areas and dramatic in the cities: from 89 to 76 percent in the rural population and from 68 to 20 percent in the urban population.

PATTERNS OF MARRIAGE

By cumulation of age-specific first-marriage rates, the proportion of women ever married at each age can be calculated for each cohort: that proportion is shown for selected female cohorts in Figure 11 (see Table A-4 for data for all years). From the cohort reaching age 15 in 1950 to the cohort reaching 15 in 1965, the curves showing age of attaining successively greater proportions of ever-married women moves to the right--to higher ages--with each cohort, ultimately reaching nearly 100 percent. The cohort reaching age 15 in 1970 has a relatively slow start in entering marriage, reaching 50 percent ever married at an age 2 1/2 years later than the attainment of 50 percent by the cohort only 5 years older (age 15 in 1965). However, the younger cohort made up for its slow early entry into marriage and by age 26 had

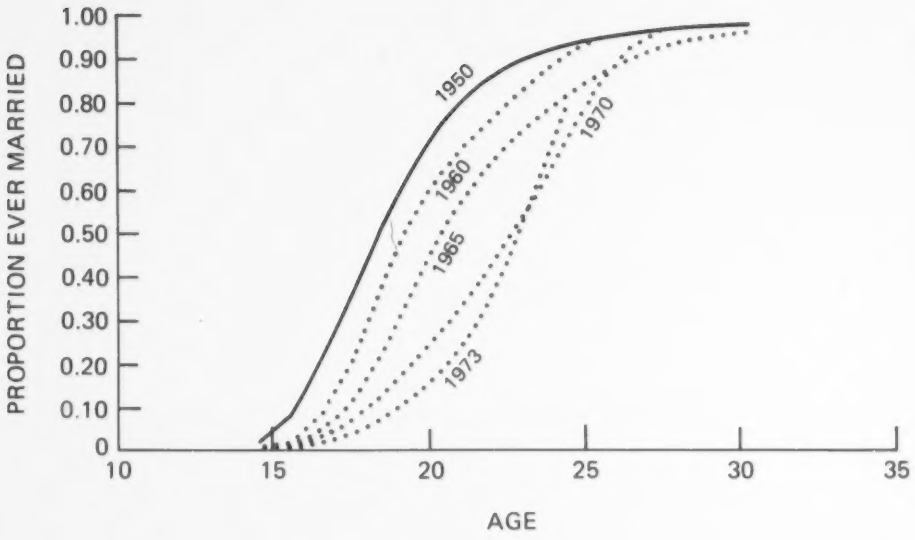


FIGURE 11 Proportion of Ever-Married Women, by Single Years of Age, Cohorts Aged 15 in 1950, 1960, 1965, 1970, and 1973: China

surpassed the proportion married that had been achieved at the same age by the older cohort. Those reaching 15 in 1973 were even slower than the 1970 cohort in entering marriage at early ages and then quickened the pace so as to surpass older cohorts--by about age 24 for the cohort 15 in 1965 and by age 23 for the cohort 15 in 1970.

In Figure 12 the curves showing cumulative entry into marriage for selected female cohorts are compared with a standard curve of cumulative first marriage. The standard curve is a mathematical function of age that with suitable choice of constants fits the marriage experience of many quite different populations. The standard distribution--an asymmetrical curve skewed to the right--fits different experiences, ranging from early-marrying to late-marrying cohorts, if the appropriate starting age (or, alternatively, the proper mean age) and the proper pace of marriage (or the proper standard deviation) is chosen. (The proportion ultimately marrying must also be specified, but in China this proportion can be estimated to a good approximation as 100 percent [Coale, 1971; Coale and McNeil, 1972]). In Figure 12, the standard curve of the proportion of ever-married women is fitted to the experience of each

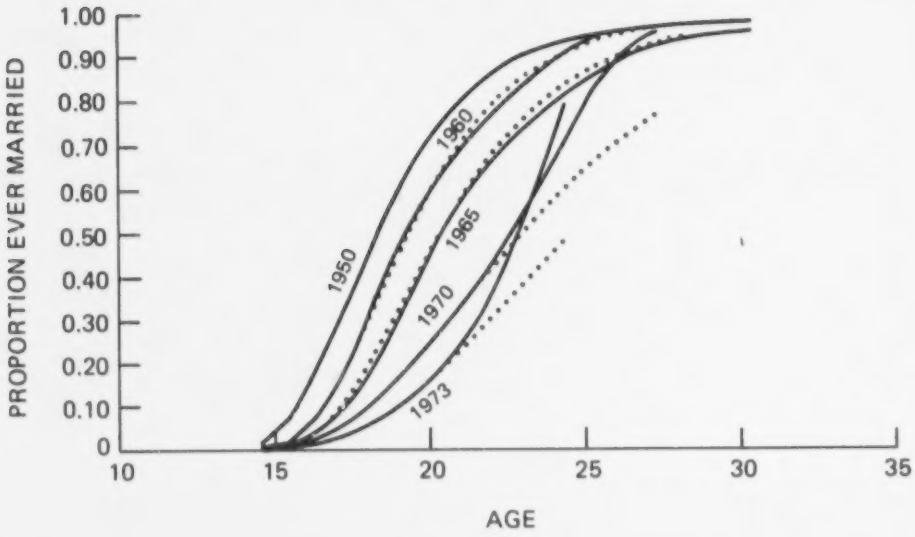


FIGURE 12 Proportion of Ever-Married Women, Cohorts Aged 15 in 1950, 1960, 1965, 1970, and 1973 (solid lines), and Standard Curves Fitted to Ages 16.5 and 20.5 (dotted lines): China

cohort by choosing two parameters (of location and spread) that forces the standard curve to pass through the cohort's recorded proportion ever married at ages 16.5 and 20.5. For cohorts reaching age 15 in 1950, 1960, and 1965, the nuptiality experience past age 20 is fitted very well indeed by the standard curves forced to pass through these early points in the cohort's entry into marriage. Those reaching 15 in 1970 also follow a standard curve fitted to the proportion ever married at 16.5 and 20.5, but only up to age 22; at higher ages the standard curve fitted to these early points rises too slowly--or, more realistically, above age 22 the cohort accelerates its entry into marriage above the slow pace it had followed up to age 22. The cohort of women aged 15 in 1973 departs still earlier and more steeply from the very slow pace of marriage it followed up to age 20.

The existence of a standard frequency distribution of first marriages has a behavioral explanation: it is generated by a normal (Gaussian) distribution of attaining an age considered as marriageable, followed by exponential distributions of the duration of three intermediate stages--the search for the ultimate spouse, the interval

between finding the spouse and engagement, and between engagement and marriage (Coale and McNeil, 1972). When age at marriage is governed by accepted social norms and gradually evolving conditions, the standard distribution seems to fit very well.

In the 1970s the intensified program to reduce the birth rate included later marriage as an important component. The legal minimum of age at marriage was not increased (from the 18 years for women set in the marriage law of 1950); however, permission to marry had to be obtained from the administrative head of the work units of bride and groom, and a late marriage rate (the proportion of marriages of women older than 23 in rural areas and older than 25 in cities) was one of the aims imposed by the new population policies (Tien, 1983). Restrictions that slowed down entry into marriage for women under age 23 led to more rapid entry into marriage for women after that age: for example, see the comparison of the 15-in-1970 cohort with the fitted standard in Figure 12.

In 1980 a new marriage law was passed that increased the legal minimum marriage age for women from 18 to 20. The passage of the new law was reportedly accompanied by a relaxation of the measures that enforced later marriage because of the social problems created by postponing marriage past age 23 in a society in which women are traditionally married soon after menarche and in which sexual relations among unmarried people are not socially acceptable. The new law was accompanied by a marriage boom: the total first-marriage rate for women rose from .922 in 1979 to 1.137 in 1980, 1.303 in 1981, and 1.314 in the first half of 1982; mean age at first marriage fell from 23.1 in 1979 to 22.7 in the first half of 1982. The departure of recent cohorts from standard curves of age at marriage may be the result, then, of government action that artificially reduced rates of first marriage at early ages and led to artificially high rates at later ages, when the pressure was off. The relaxation of pressure against marriages at ages under 23 led to a marriage boom. The effects of these marriage patterns on fertility are explored in the next chapter.

CHAPTER 4

CHILDBEARING IN CHINA SINCE 1950

TOTAL FERTILITY RATES

The published report on the 1/1,000-sample survey of fertility in 1982 includes data on age-specific fertility rates by single years of age from 1950 through 1981. The published tables also include single-year rates for the rural and urban populations for these years and a separately tabulated set of rates for the total population extending back to 1940. The detailed fertility histories were obtained by interviewing women aged 15-67. Because of the upper age limit, the age-specific fertility rates presented for women aged 49 are derived from actual responses of the women interviewed only for years after 1964, rates for women aged 45 are derived from responses only after 1959, etc. The upper age limit of the women interviewed also means that all rates above age 25 in 1940 were estimated by methods not explicitly described.

As noted above, comparison of the annual number of births thus calculated with the annual number from official sources indicates that the official number of births is understated. The comparison also shows systematically lower ratios of official numbers of births to calculated numbers of births for years that have 13 lunar months. It is thus clear that the number of births reported in the fertility survey in those years was too high. Table 5 shows birth rates and total fertility rates (TFRs) based on the estimated annual number of births calculated from the fertility rates reported from the survey. Also shown in Table 5 are birth rates and TFRs adjusted for overstatement of births in years with 13 lunar months and for understatement in other years. If all births were reported by the lunar calendar, 13-month years would have 1.05 times the number of births

TABLE 5 Birth Rate and Total Fertility Rate Derived from Fertility Survey: China

Year	Unadjusted		Adjusted[a]	
	Birth Rate (per 1,000)	TFR	Birth Rate (per 1,000)	TFR
1950	46.5	5.81	41.3	5.93
1951	39.8	5.70	40.6	5.82
1952	45.1	6.47	43.7	6.26
1953	42.2	6.05	43.1	6.17
1954	43.5	6.28	44.4	6.41
1955	42.7	6.26	41.3	6.06
1956	39.4	5.85	40.2	5.97
1957	42.5	6.41	41.1	6.21
1958	36.9	5.68	37.7	5.80
1959	27.7	4.30	28.3	4.39
1960	26.0	4.02	25.2	3.89
1961	21.9	3.29	22.3	3.36
1962	40.1	6.02	40.9	6.14
1963	48.9	7.50	47.3	7.26
1964	39.9	6.18	40.7	6.31
1965	38.9	6.08	39.7	6.20
1966	39.6	6.26	38.3	6.06
1967	33.4	5.31	34.1	5.42
1968	40.4	6.45	39.1	6.24
1969	35.8	5.72	36.5	5.84
1970	36.5	5.81	37.2	5.93
1971	34.6	5.44	33.5	5.27
1972	31.8	4.98	32.4	5.08
1973	29.5	4.54	30.1	4.63
1974	28.0	4.17	27.1	4.04
1975	24.8	3.57	25.3	3.64
1976	23.2	3.24	22.5	3.14
1977	21.1	2.84	21.5	2.90
1978	20.8	2.72	21.2	2.78
1979	21.6	2.75	20.9	2.66
1980	18.1	2.24	18.5	2.29
1981	21.2	2.63	(21.2)	(2.63)
1982	21.3	2.66	(21.3)	(2.66)

[a]Adjusted to correct for effect of lunar calendar and for understatement in other years.

in a solar calendar year, and 12-month years would have .97 times the number in a solar year. The adjusted birth rates and TFRs are calculated on the assumption that two-thirds of the reported births are based on lunar years: leap-year (13-months) rates were divided by 1.033 and non-leap-year (12-months) rates by 0.98.

The unadjusted total fertility rates in Table 5 are taken directly from the report on the fertility survey, which also contains partially estimated TFRs for 1940-49, with an average value of 5.44 for that decade. This rate differs very little from the total fertility rate of 5.50 estimated by Barclay and others (1976) for the Chinese farm population in 1929-31. The total fertility rate from the survey rises to about 6.0 through the 1950s until 1958, when a dramatic decline begins. An increase in fertility from 5.5 to 6.0 as part of the first impact of modernizing forces is not unusual. It frequently occurs because of the diminished effect of various customs and practices that restrict fertility below its potential maximum in almost every less-developed country. These customs and practices, which do not vary according to the number of children already born and hence are not intended to impose a direct limit on the size of the family, include prolonged breastfeeding, periodic separation of spouses because of seasonal migration, prohibition of intercourse during lactation, etc.[7]

The most striking features of the sequence of TFRs are the dramatic reduction from 1956 to 1961 (the TFR in 1961 is only a little more than half of the TFR in 1957); the recovery in 1962 to a TFR similar to the 1950s; and the unique, very high TFR of 7.5 in 1963. The TFR in the mid-to-late 1960s was comparable to the mid-1950s except for a temporary drop in 1967, coinciding with the Cultural Revolution. A sustained decline began after 1970, reaching a low in 1980 that was more than 60 percent below the level in 1970; there was a modest recovery in 1981, but only to a fertility level still well below half the level in 1970. These episodes of a large reduction, an extraordinary recovery, and a subsequent major decline are analyzed further below.

THE EFFECT OF CHANGES IN NUPTIALITY ON THE RATE OF CHILDBEARING

Changes in age at marriage have a different effect on fertility in populations in which married couples

practice little contraception and therefore have similar age-specific marital fertility rates whatever the age at marriage and in populations in which married couples effectively control fertility and attain fixed targets of completed size of family. In noncontracepting populations, increases in age at marriage reduce the number of children born to each cohort of women by reducing the number of younger women exposed to the risk of childbearing. The reduced number of younger women who are currently married causes lower fertility in each time period as well as for each cohort. In populations practicing effective contraception, changes in age at marriage alter the timing of births for each cohort of women without necessarily altering the final average size of family achieved. A postponement of childbearing caused by later marriage produces a temporary reduction in period fertility even if cohort total fertility is not changed. When age at marriage stops increasing, this temporary depression of fertility ends.

The effect of increasing age at marriage on fertility even when each cohort achieves the same family size is not generally noticed nor well understood. Imagine, for example, that all women marry at the mean age of marriage and bear only one child, one year after marriage. Suppose that for a long period the age at marriage is 22 years and that both the total first-marriage rate and the total fertility rate are 1.0. Then suppose that at a certain moment the mean age at marriage rises to 23 years. In the year following this shift, there would be no marriages because the cohort that was 22 in the preceding year would all have already married and the cohort becoming 22 in the given year would not marry until reaching 23 a year later. In the ensuing year there would be no births for a similar reason. So from a one-year increase in age at marriage (and age at childbearing) there would be a loss of a full year's quota of marriages and a full year's quota of births even though the proportion ever marrying and the completed family size for every cohort remained fixed. In a more complex change of the sort that actually occurs, a rise in the mean age at marriage within a period of time means that one year's quota of marriages is lost, not in a single year, but during a span of several years. A rise by one year in the mean age of childbearing also means the loss, over a span of years, of one year's quota of births, even though completed size of family of cohorts does not change.

The effect of changes in age at marriage on changes in the total fertility rate can be evaluated under two quite different assumptions about the fertility of the married women when age at marriage is changing. One assumption is that the fertility of married women at each age remains constant as age of entry into marriage changes. This assumption is logically tenable if there is very little contraceptive practice. The second assumption is that the fertility of married women at each duration of marriage remains fixed, with a duration-specific fertility schedule that declines quite steeply because each marriage cohort is curtailing its childbearing after the early attainment of desired family size.

The change in fertility associated with changing nuptiality in China can be estimated under both of these assumptions. First the effect of changes in age at marriage on total fertility is determined when the schedule of age-specific marital fertility is fixed. The proportion of ever-married women at each age in selected years is combined with the age-specific fertility of the ever-married women in 1956. The age pattern of marital fertility in the 1950s (see below) differs little from the age pattern characteristic of populations that do not deliberately control fertility (do not try to reduce childbearing when desired family size has been reached) by contraception or abortion. The first calculation shows the reduction in the total fertility rate that would have occurred if the virtual absence of contraception and abortion of the 1950s had continued (and if there had been no change in factors, such as duration and intensity of breastfeeding, that affect marital fertility in the absence of contraception). The data provided in the report of the 1982 fertility survey are the basis for this calculation. The proportion of ever-married women at each age in each year since 1950 is estimated by the cumulation of first-marriage rates for each cohort (see Table A-4).[8] Division of the tabulated overall age-specific fertility rate at a given age by the proportion ever married at that age yields an age-specific fertility rate of ever-married women. The next step is to multiply the proportion of ever-married women at each age in different years by the age-specific ever-married fertility rates of 1956. The results are shown in Table 6. The total fertility rate would have fallen by a little more than 20 percent from 1950 to 1980 and then risen by several percent to 1982 if the ever-married fertility rates of 1956 had been in effect. Most of the decline in

TABLE 6 Total Fertility Rate Calculated for Selected Years, from Proportion of Women Ever Married and Age-Specific Marital Fertility Rates, 1956: China

	Year							
	1950	1955	1960	1965	1970	1975	1980	1982
Calculated TRF	5.97	5.87	5.68	5.62	5.42	4.96	4.71	4.88
TFR of 1950=100	100	98.3	95.1	94.1	90.8	83.1	78.9	81.7

total fertility rate would have occurred after 1970, when the greater part of the rise in age at marriage occurred. The TFR in 1980 was 61 percent lower than the TFR in 1950; the decline that would have occurred from changes in marriage alone, with constant marital fertility rates, is thus about one-third of the actual decline.

The second calculation of the effects of changing nuptiality is limited to the years after 1970, when the change in nuptiality was greatest and when there was a major increase in the deliberate restriction of marital fertility by contraception and abortion. The rationale of this calculation is different from the first. Duration-specific marital fertility rates have been calculated for 1970, 1977, and 1981 from data in the 1982 fertility survey that give the number of births to women at marriage durations of 0-1, 1-2, . . ., 19-20, and 20+ years in those 3 years and from estimates of the number of ever-married women classified by duration of marriage (Song et al., 1983). The number of women by age in each year have been determined by intracohort interpolation: multiplication by the proportion ever married provides the number of ever-married women by age, and the distribution of the ever-married at each age by duration can then be ascertained from the sequence of first-marriage rates in the cohort for earlier years and younger ages. (The estimated number of ever-married women by duration of marriage from 1970 to 1982 is shown in Table A-5.) The ratio of births by duration since first marriage to number of ever-married women by duration provides a set of duration-specific ever-married fertility rates for 1970, 1977, and 1981 (see Table A-6). The next step is to assume that the married women in each year from 1970 on were subject to 1981 duration-

specific fertility rates. This assumption is based on the hypothesis that women during the 1970s were as effective in limiting marital fertility at every stage of marriage as were women at the corresponding stage of marriage in 1981. Such a hypothesis is acceptable (even as an hypothesis) only when it incorporates a schedule of duration-specific fertility that falls off rapidly after relatively high values at early durations, because only then would it be possible for duration-specific fertility to remain unchanged when mean age at marriage increases. When fertility is little controlled (as in 1956) women marrying at age 25 might have about the same fertility at each duration during the first 10 years of marriage as women marrying at 21, but not in the 20th year, when reduced capacity for reproduction would cause lower fertility among those who had married at 25.

In short, the calculation of the births that would have occurred from 1970 to 1981 with the duration-specific fertility rates of 1981 illustrates the change in total fertility rate that would have resulted from changes in age at marriage, even if each cohort had maintained lifetime fertility approximately constant but had shifted the time of childbearing by marrying later. Table 7 shows the results. There were almost 30 million births in 1970; with 1981 duration-specific fertility there would have been only about 16 million. The TFR in 1970 would have been only 3.09 with 1981 duration-specific rates; it was 5.81. Had the rates remained unchanged at the low level, the TFR would have declined from 3.09 in 1970 to a low of 2.41 in 1979 and then risen to 2.85 in 1981. With no change in duration-specific fertility rates (and therefore approximately constant cohort total fertility), there would have been a decline to only 78 percent of the 1970 TFR in 1979 and then a recovery to 92 percent in 1982.

The two calculations--with constant age-specific fertility rates (as of 1956) and constant duration-specific rates (as of 1981)--illustrate different sorts of influence that changes in age at marriage can have on overall fertility. The first calculation shows that had there been no increased use of contraception (and no change in "natural" fertility from reduced breastfeeding), the TFR would have fallen by about 20 percent from 1950 to 1980 because rising age at marriage would have reduced the average exposure to married life and the attendant risk of childbearing. The second calculation shows that even with fixed, highly controlled marital fertility in

TABLE 7 Annual Births (in millions), Total Fertility Rate, 1970-82: China

Year	Actual Number of Births (in millions)	Births with 1981 Duration-Specific Fertility (in millions)	Actual Total Fertility Rate (per 1,000 women)	Total Fertility Rate with 1981 Duration-Specific Fertility (per 1,000 women)
1970	29.84	15.87	5.81	3.09
1971	28.94	16.30	5.44	3.06
1972	27.38	16.32	4.98	2.97
1973	26.05	16.30	4.54	2.84
1974	25.18	16.31	4.17	2.70
1975	22.64	16.41	3.57	2.59
1976	21.58	16.69	3.24	2.50
1977	19.93	17.15	2.84	2.44
1978	19.93	17.67	2.72	2.41
1979	20.93	18.32	2.75	2.41
1980	17.73	19.39	2.24	2.45
1981	21.03	21.03	2.63	2.63
1982	21.56[a]	23.13	2.66[a]	2.85

Note: Actual numbers and rates; hypothetical numbers and rates resulting from duration-specific fertility of 1981.

[a]Estimated.

which childbearing beyond the early durations of marriage is severely limited, the TFR would have declined by about 20 percent from 1970 to 1979 because rising age at marriage during these years would have reduced the number of married women at early durations. Recall that the total first-marriage rate was low during most of the 1970s (as low as 0.64) despite the continuation of universal entry into marriage cohort by cohort. The increase in mean age at marriage that was the principal source of low total marriage rates also produced a reduced number of women in the early durations of marriage. The cessation and slight reversal of the increase in age at marriage, plus the marriage boom associated with the new marriage law of 1980, produced a phenomenal increase in the total marriage rate and a commensurate increase in the number of marriages of short duration. A consequence is that a rise in overall fertility by 18 percent (from a TFR of 2.41 in 1979 to one of 2.85 in 1982) would have occurred with constant fertility by duration of marriage.

The report of the 1982 fertility survey does not provide a time series of age-specific rates of fertility by order of birth, but it does show such rates for 1980 and 1981. The total first-birth rate (the sum over all childbearing ages of age-specific rates of bearing a first child) rose from 0.869 in 1980 to 1.162 in 1981--nearly three-fourths of the increase in the total fertility rate. (Of the increase in the TFR, 90 percent is in the total first-birth rate plus the total second-birth rate, both increases largely the result of compression in 1981 of first and second births by women at different ages into the same time period because of the marriage boom and the reduction in age at marriage.) Some increase in fertility would occur with constant duration-specific fertility even if age at marriage merely stopped rising. If the continued increase in age at marriage had ceased and not reversed, the total first- marriage rate would have returned to about 1.0; the persistent shortage in the annual number of first marriages caused by rising mean age at marriage would have ended.

AGE PATTERNS OF MARITAL FERTILITY

One of the benefits of the detailed information that appears in the report of the 1982 fertility survey is the feasibility of calculating age-specific marital fertility schedules. To do so, the proportion of ever-married

women by age is determined from the data on first marriages; a fertility schedule of the ever-married women is then obtained by dividing the overall fertility of women at each age by the proportion ever married. Finally, the marital fertility schedule is derived by a further division of the ever-married rate at each age by the estimated proportion of currently married to ever-married women. This last proportion can be estimated as having approximately the same values in different calendar years because of the surprisingly little difference between it in 1982 and in the Chinese farm population in 1930. The proprortion of currently married to ever-married women at the two dates are as follows:

	Age				
Year	20-24	25-29	30-34	35-39	40-44
1982	.986	.977	.960	.933	.888
1929-31	.981	.968	.953	.916	.860

The very slight difference in these ratios despite the very substantial difference in mortality implies that the higher incidence of widowhood at the earlier date must have been offset by a high rate of remarriage of widows. Approximate age-specific marital fertility schedules by single years of age from 20 through 39 have been calculated for selected years. In every year the ratio of currently married to ever-married women was assumed equal to the average of the ratios for 1929-31 and 1982.

In Figure 13, marital fertility rates are shown relative to a schedule of "natural" fertility, with the ratio to natural fertility at ages 20-24 set equal to 1.00. The comparison with natural fertility provides indirect evidence of the extent to which marital fertility is affected by deliberate control through the use of contraception and abortion. Louis Henry (1961) was the first to note that the age pattern of marital fertility was similar in different populations in which couples do not practice contraception or take other measures to reduce fertility after a certain family size is reached; he called such fertility "natural." In

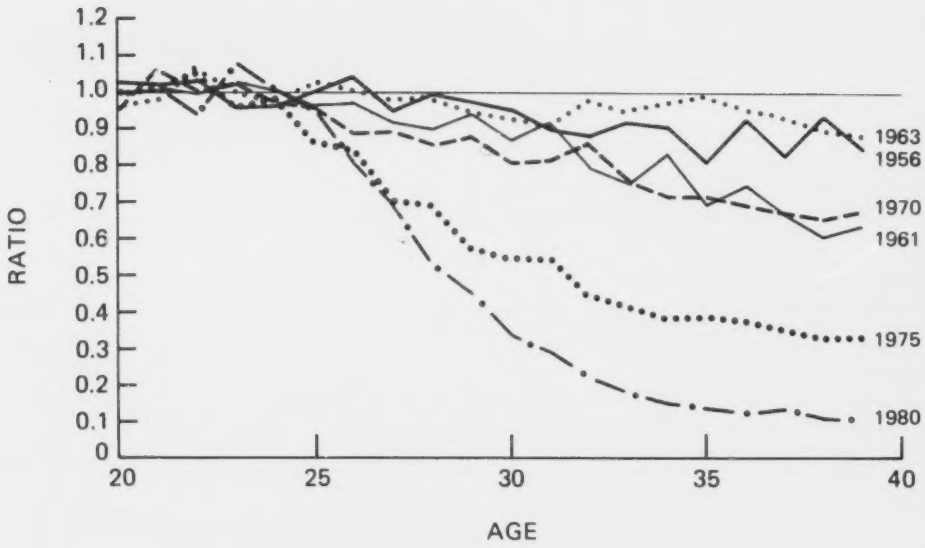


FIGURE 13 Ratio of Age-Specific Marital Fertility to Natural Fertility (with ratio at 20-24 set at 1.00), 1956, 1961, 1970, 1975, and 1980: China

Figure 13, the calculated marital fertility rates are divided by a set of natural fertility rates, with the two schedules--a schedule for China and an average of natural fertility schedules selected for good quality of data from those cited by Henry (Coale and Trussell, 1974)--brought to the same average at ages 20-24. In 1956 the ratio of marital fertility to natural fertility remains above 0.9 except for two points that are probably the result of sampling variation or slightly inexact reporting by respondents who were over age 60 in 1982. In 1961 the TFR was only 56 percent of the TFR in 1956; the reduction in marital fertility was large at younger ages (a 34 percent reduction at 20-24) as well as at older ages (a 49 percent reduction at 35-39). To achieve the modestly increased departure as age increases from the low level of natural fertility schedule in 1961 would entail only a modest use of deliberate limitation by older women.

Low fertility among young as well as older married women in 1961 is consistent with restriction of childbearing caused not only by contraception but by social disruption and the famine conditions in 1960. As noted below, a very high peak in the death rate occurred

in 1960, the result of a famine associated with crop failures induced by a combination of chaotic economic conditions, drought, and floods. Famine is known to prevent ovulation and to reduce male libido. Disruption of normal family life while the population was mobilized for various projects and engaged in searches for food, like the direct effects of famine on reproductive capacity, would cause fertility to fall at all ages. The death-rate peak in 1960 implies that 1960 was the worst of the crisis; reduced conceptions in 1960 would produce a very low TFR in 1961. The slightly steeper reduction in marital fertility relative to natural fertility as age increases in 1961 compared with 1956 may have been caused by the greater susceptability of older women to fertility impairment during a famine. A further indication of a quasi-biological basis for the very low marital fertility in 1961 is the height of the peak in fertility reached in 1963. The TFR of 7.50 in 1963 is well above the highest TFR during the 1950s (6.41 in 1957). The age structure of marital fertility in 1963 is very similar to 1956, but at a much higher level. The 1963/1956 ratio of marital fertility rates by five-year intervals for women aged 20-24 to 35-39 varies only from 1.33 to 1.38. The 1963/1961 ratio of marital fertility rates increases from 2.06 at 20-24 to 2.70 at 35-39, possibly because of the cessation of whatever slight degree of contraceptive practice there may have been in 1960-61 or possibly because the catastrophic situation in 1960-61 impaired the fertility of older women more than the fertility of younger women. Marital fertility that is at least one-third higher in 1963 than in 1956 at every five-year age interval from 20 to 40 implies a much higher than normal susceptability to pregnancy. The source of such above-normal susceptability was doubtless an abnormally low proportion of women who had recently given birth (who experience many months without ovulation if they breast-feed) and also an abnormally high number of newlyweds (the total first-marriage rate in 1962 was 1.19).

In sum, the very low fertility of 1961 was probably caused by the disruption of normal married life and by famine-induced subfecundity; the unequaled high fertility of 1963 resulted from the restoration of normal marital life, from an abnormally large number of marriages, and from the unusually small fraction of married women who were infertile because of nursing a recently born infant. The age structure of marital fertility was essentially that of natural fertility, unaffected by

deliberate restriction, in 1956 and again in 1963. At the low point in 1961, marital fertility fell with age slightly more steeply than does natural fertility. This pattern may have resulted either from some practice of folk methods of contraception or abortion or from a greater biological effect of the crisis on older women. In 1970 the decline of marital fertility with age relative to natural fertility closely paralleled the corresponding curve for 1961 (see Figure 13 above); but in 1970 this decline was almost certainly the result of an increase in deliberate control with age and not to the biological factors that may have affected older women disproportionately in 1960-61. In 1975 the steep fall of fertility relative to natural fertility clearly shows the much greater effect of fertility restriction among older women; by 1980 the decline in marital fertility with age is comparable to the structure of marital fertility in highly developed societies with total fertility rates below replacement levels.

DIFFERENTIAL FERTILITY

Urban/Rural Differences

The 1982 sample fertility survey provides annual data on fertility and nuptiality in the detail already described for the rural and urban populations as well as for the total. The TFRs for the rural and urban populations are given in Table 8 and shown graphically in Figure 14. In the early 1950s average overall urban fertility increased relative to rural fertility from about 80 to about 90 percent, and it remained at a constant ratio of about 90 percent until 1959 and 1960; evidently, rural fertility was more affected by the Great Leap Forward than was urban fertility. From 1960 to 1966 the ratio of rural to urban TFR fell to about 50 percent, and since then the ratio has been nearly constant. In absolute terms, rural fertility in 1964 returned (after the crisis deficit and the postcrisis peak) to about the level of the 1950s, while urban fertility barely surpassed its 1957 level even in 1963, fell steeply for a few years after 1963, recovered somewhat in 1968, and then fell at the same relative rate as did rural fertility. The decline of urban fertility from 90 percent of rural fertility in the late 1950s to about 50 percent in the late 1960s (while rural fertility remained little changed) appears to

TABLE 8 Total Fertility Rates, Rural and Urban Populations, 1950-81: China

Year	Total Fertility Rate		
	Rural	Urban	Urban/Rural
1950	5.963	5.001	.839
1951	5.904	4.719	.799
1952	6.667	5.521	.828
1953	6.183	5.402	.874
1954	6.390	5.732	.897
1955	6.391	5.665	.886
1956	5.974	5.333	.893
1957	6.504	5.943	.914
1958	5.775	5.253	.910
1959	4.323	4.172	.965
1960	3.996	4.057	1.015
1961	3.349	2.982	.890
1962	6.303	4.789	.760
1963	7.784	6.207	.797
1964	6.567	4.395	.669
1965	6.597	3.749	.568
1966	6.958	3.104	.446
1967	5.847	2.905	.497
1968	7.025	3.872	.551
1969	6.263	3.299	.527
1970	6.379	3.267	.512
1971	6.011	2.882	.479
1972	5.503	2.637	.479
1973	5.008	2.387	.477
1974	4.642	1.982	.427
1975	3.951	1.782	.451
1976	3.582	1.608	.449
1977	3.116	1.574	.505
1978	2.968	1.551	.523
1979	3.045	1.373	.451
1980	2.480	1.147	.463
1981	2.910	1.390	.478

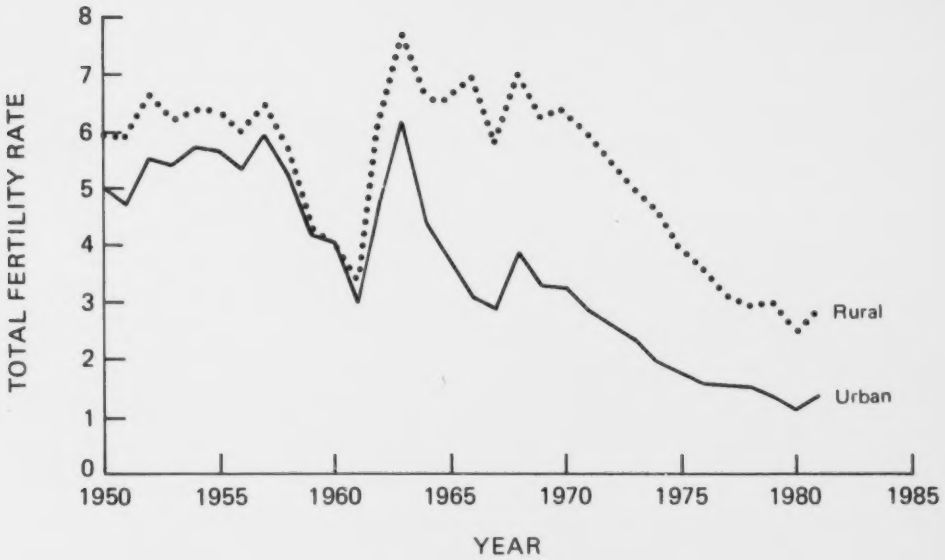


FIGURE 14 Total Fertility Rates, Rural and Urban Populations, 1950-81: China

conform to the classic picture often ascribed to (but not always followed by) European fertility during the so-called demographic transition: the urban population has a higher age at marriage; it starts deliberate family limitation before the rural population does; and after the transition starts in the rural population, the urban population continues to have lower rates of childbearing. The early timing of the urban decline has a simpler explanation, however: the antinatalist program was initiated earlier and pursued more vigorously in the cities.

Age-specific fertility rates of the rural and urban populations in 1955, 1968, and 1980 are compared in Figure 15. In 1955 the difference between rural and urban TFRs is composed almost equally of lower fertility below age 25 in the cities (caused by later marriage) and lower fertility above age 31 in the cities (caused by a modest prevalence of contraception and abortion or possibly by a higher proportion of widows). In 1968, the rural fertility schedule looks much like the schedule in 1955 though slightly higher, except at the younger ages, where slightly later marriage reduced fertility. The early part of the urban schedule in 1968 shows the strong effect of later marriage and the later part the strong

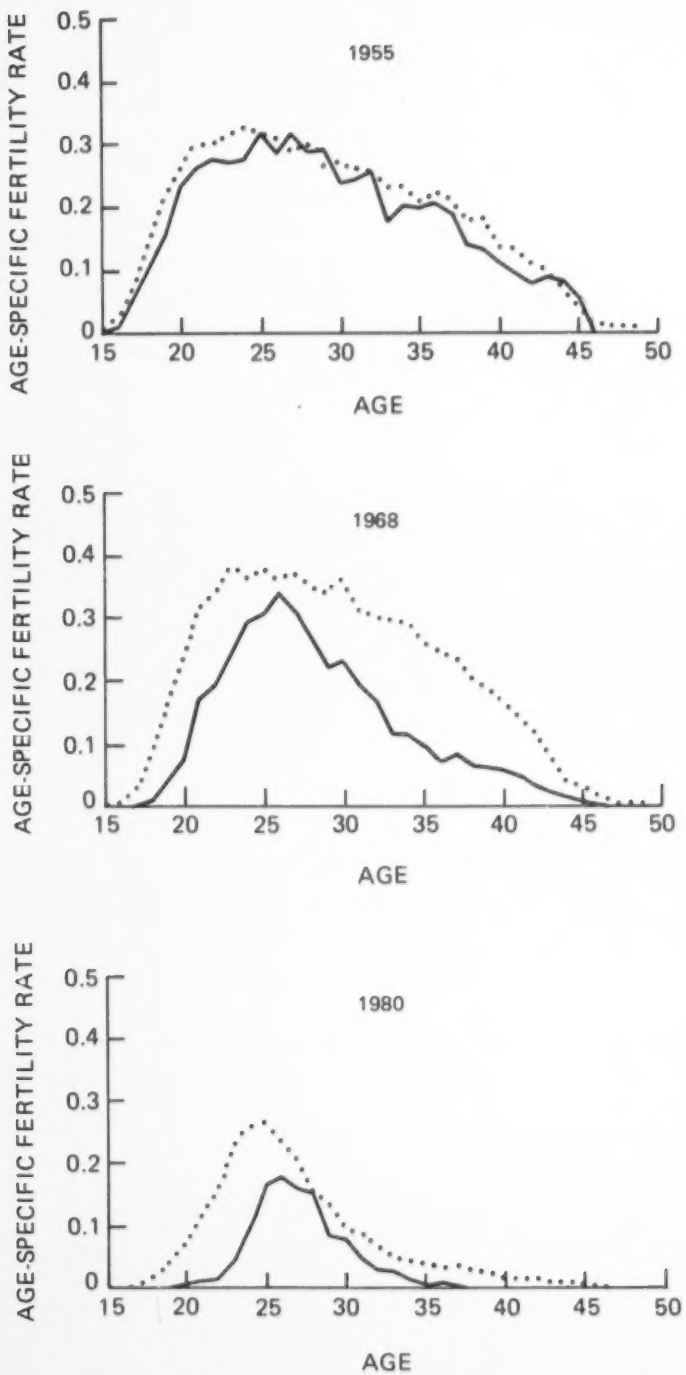


FIGURE 15 Age-Specific Fertility Rates, Rural (dotted line) and Urban (solid line) Populations, 1955, 1968, and 1980: China

effect of deliberate birth control. By 1980 these effects are evident in the rural fertility schedule but are still stronger for the urban schedule.

Han and Minority Group Differences

Another major difference in fertility in China is revealed by data on the childbearing rates of the rural Han population (the dominant Chinese ethnic group) and those of the ethnic minorities, with a total population of some 60 million persons (6 percent of the population). (Li et al., 1983). The minorities have been exempt from most of the pressures of the official antinatalist program, are generally more isolated and less educated, have strong pronatalist traditions, and have much higher fertility. In 1981 the TFR of the minority populations was 5.05 compared with 2.76 for the rural Han. The age-specific fertility schedule of the minorities shows the effect of earlier marriage up to age 25 and less effective control of fertility at higher ages (Figure 16).

Other Fertility Determinants

There are also differences in fertility for women with different levels of education and with differences in occupation. In 1982 the average number of children ever born to women aged 35-49 was 4.74 for illiterate women, 3.81 for women with primary school education, 3.08 for women finishing junior high school, 2.41 for women finishing senior high school, and 1.94 for university-educated women. (These figures, taken from the report of the survey, are subject to the following bias: the women at higher levels of education are more concentrated near age 35 in the 35-49 age interval because of rapid change in education in China; their average parity is lowered by this compositional feature.) At age 50 farmers had an average parity of 5.95, workers of 4.27, and cadres of 3.10 (Li and Zhang, 1983; Zhao and Sun, 1983).

CONTRACEPTIVE PRACTICE IN CHINA

In a chapter entitled "Birth Control of Women of Reproductive Age" in the special issue of Population and Economics (Qui et al., 1983) devoted to the large-scale

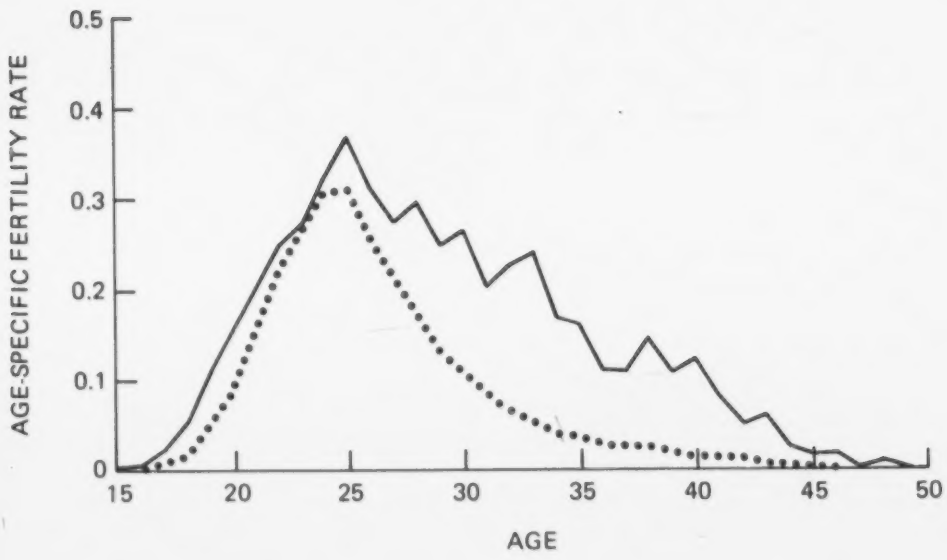


FIGURE 16 Age-Specific Fertility Rates, Ethnic Minority Women (solid line) and Rural Han Women (dotted line), 1981: China

fertility survey, it is reported that 69.5 percent of married women aged 15-49 were practicing contraception in 1982. Of these, 25 percent used female sterilization, 10 percent male sterilization, 50 percent IUDs, 8 percent the pill, and 6 percent condom and other (Qui et al., 1983). The overall rate of use is not very different from Taiwan (65 percent), Hong Kong (72 percent), or Japan (69 percent), but the use of sterilization was more frequent in China than in those neighboring populations (Population Reference Bureau, 1983).

CHAPTER 5

MORTALITY IN CHINA

METHODS

The accuracy of age reporting and the apparent consistency of coverage in the censuses of 1953, 1964, and 1982 makes it possible to construct life tables for each intercensal period, life tables that express the average mortality during the intervals of 1953-64 and 1964-82. Calculation of life tables expressing survival rates and death rates beginning at age zero is possible because the accurate age-specific fertility rates reported from the fertility survey provide the basis for accurate determination of the number of births for each intercensal year.

The construction of life tables is facilitated by a set of relations that are exactly fulfilled in any population that does not gain or lose by migration. The relation relevant to the construction of an intercensal life table is

$$N(x) = N(0)e^{-\int_0^x r(y)dy}(\ell_x/\ell_0) ,$$

where N(x) is the total number of persons who attain exact age x during a specified time period, r(y) is the average rate of increase of persons at age y during the period, and ℓ_x/ℓ_0 is the proportion of persons surviving from birth to age x in a hypothetical cohort subject at each age to the mean death rate at that age in the intercensal period. The mean death rate is defined as the total number of deaths in a given age interval during the time period divided by the total number of person-years-lived in that age interval. This equation can be solved for ℓ_x/ℓ_0, i.e.,

$$\ell_x/\ell_0 = (N(x)/N(0))e^{\int_0^x r(y)dy}.$$

Consequently, to construct a life table it is necessary only to estimate the total number who attain each single year of age x during the intercensal period and to calculate the average growth rates ($_1r_0$, $_1r_1$, $_1r_2$, etc.) of persons at age zero to 1, 1 to 2, etc. during the period. To be precise, these rates are the increase in the number of persons at a given age (say 10-11) divided by the number of person-years-lived at that age. If N(x) is the number attaining age x, the number of person-years-lived from x to x + 1 is approximately (N(x) + N(x+1))/2.

In short, a highly precise life table can be formulated for the period between two censuses if the number attaining each age N(x) can be determined with precision. If the census age distributions recorded in the two censuses are exact and the annual number of births is accurately recorded, N(x) can be accurately calculated. The technique for accurate determination of N(x) is cohort interpolation. For example, it is possible to estimate the number of people who attained exact age 10 of those who were 6-7 in 1953 and 17-18 in 1964 by subtracting a fraction of the total decrease in this cohort during those 11 years. The overall decrease is the number of deaths the cohort experienced between ages 6-7 and ages 17-18; the relevant fraction of the decrease is the proportion of deaths from 6.5 to 17.5 that occur between 6.5 and 10.0. This fraction--an interpolation factor--can be taken roughly as 3.5/11 (on the assumption of an even distribution of deaths) or, more precisely, from a model life table at an approximately appropriate level of mortality.[9]

When the number of people attaining age x has been determined for each cohort that passes through x between the censuses, N(x) is found by taking the total for all such cohorts. The number at age zero is the number of births between the censuses, which is equal to the sum of the number of births calculated for each intercensal year from the number of women at each age from 15 to 49 multiplied by the age-specific fertility rates. Annual births are divided into male and female on the assumption of 106 male births for every 100 female births (51.5 percent male).

LIFE TABLES

The female life tables are more soundly based than the male life tables, because it was necessary to correct the number of males at young adult ages (see above). Abridged life tables for each sex are given in Table 9.

Expectation of life at birth (the mean duration of life or average age at death) according to the average mortality in 1953-64 was 42.2 years for males and 45.6 years for females. In 1964-82 it rose to 61.6 years for males and 63.2 for females. An increase of nearly 20 years in life expectancy in about 15 years is a very rapid increase indeed, even when allowance is made for the high mortality in 1959-61.

Two other data sources from which life tables for China can be calculated were noted earlier, the 1973-75 epidemiological survey and a large-scale survey in 1978. Figure 17 shows female mortality rates at ages 0-1, 1-5, 5-10, 10-15, . . . 80-85 for the two intercensal life tables and the two survey-based sources. The age pattern of mortality is quite similar, and the evolution of mortality rates is in the expected direction. Since the sample data from the 1978 survey were inflated to match exactly the official year-end population and the official figure for the number of deaths, it follows that the death rates derived from the survey are, on average, a little too low.

The 1982 census collected information about deaths in 1981, classified by age and sex, in each household. A life table calculated on the basis of those reported deaths and the 1981 age distribution derived from the 1982 census was presented in March 1984 at the international seminar on the 1982 census held in Beijing (Jiang et al., 1984). According to this life table, there was a further increase in expectation of life at birth to 66.4 years for males and 69.4 years for females.

CRUDE DEATH RATES

The crude death rate from 1953 to 1982 based on the officially recorded number of deaths is shown in Table 10 together with an estimated sequence in which the rates are adjusted for underreporting. The adjustment for each year is based on a crude estimate of the annual proportion underreported, an estimate based on the assumption of rising completeness of recorded deaths until 1964 and

TABLE 9 Abridged Life Tables, Male and Female, 1953-64 and 1964-82: China

	Male			Female		
Age	l(x)	m(x)	e(x)	l(x)	m(x)	e(x)
1953-64						
0	1.00000	0.13789	42.20	1.00000	0.14212	45.58
1	0.87101	0.02354	47.38	0.86731	0.02586	51.47
5	0.79368	0.00630	47.85	0.78315	0.00708	52.85
10	0.76909	0.00384	44.31	0.75592	0.00360	49.67
15	0.75443	0.00498	40.11	0.74243	0.00314	45.52
20	0.73588	0.00680	36.05	0.73087	0.00433	41.20
25	0.71127	0.00849	32.21	0.71521	0.00618	37.04
30	0.68168	0.01010	28.50	0.69344	0.00728	33.12
35	0.64807	0.01415	24.84	0.66863	0.01024	29.26
40	0.60372	0.01880	21.48	0.63521	0.01332	25.66
45	0.54948	0.02373	18.35	0.59427	0.01560	22.25
50	0.48786	0.03133	15.34	0.54964	0.01894	18.86
55	0.41688	0.04424	12.52	0.49989	0.02660	15.48
60	0.33366	0.06446	10.00	0.43737	0.04169	12.32
65	0.24090	0.09186	7.88	0.35446	0.06450	9.59
70	0.15125	0.13100	6.10	0.25580	0.09824	7.31
75	0.07754	0.18663	4.63	0.15518	0.14834	5.44
80	0.02968	0.26500	3.47	0.07246	0.22303	3.96
85	0.00747	0.37475	2.56	0.02271	0.33336	2.82
90+	0.00103	0.53677	1.86	0.00388	0.50614	1.98
1964-82						
0	1.00000	0.05042	61.64	1.00000	0.05467	63.22
1	0.95082	0.00616	63.81	0.94679	0.00700	65.75
5	0.92778	0.00292	61.36	0.92078	0.00334	63.57
10	0.91437	0.00122	57.24	0.90555	0.00120	59.61
15	0.90882	0.00190	52.57	0.90014	0.00167	54.95
20	0.90022	0.00308	48.04	0.89267	0.00229	50.39
25	0.88648	0.00338	43.75	0.88249	0.00267	45.94
30	0.87162	0.00357	39.45	0.87077	0.00315	41.52
35	0.85618	0.00381	35.12	0.85718	0.00374	37.14
40	0.84002	0.00442	30.74	0.84131	0.00435	32.80
45	0.82165	0.00618	26.37	0.82322	0.00572	28.46
50	0.79664	0.01025	22.12	0.79999	0.00864	24.21
55	0.75676	0.01681	18.14	0.76611	0.01319	20.16
60	0.69556	0.02793	14.51	0.71711	0.02165	16.36
65	0.60441	0.04507	11.29	0.64322	0.03542	12.93
70	0.48150	0.07363	8.51	0.53813	0.05755	9.95
75	0.33133	0.11940	6.22	0.40223	0.09216	7.44
80	0.17967	0.19251	4.39	0.25155	0.14698	5.39
85	0.06596	0.30775	3.01	0.11799	0.23294	3.79
90+	0.01279	0.49929	2.00	0.03480	0.38571	2.59

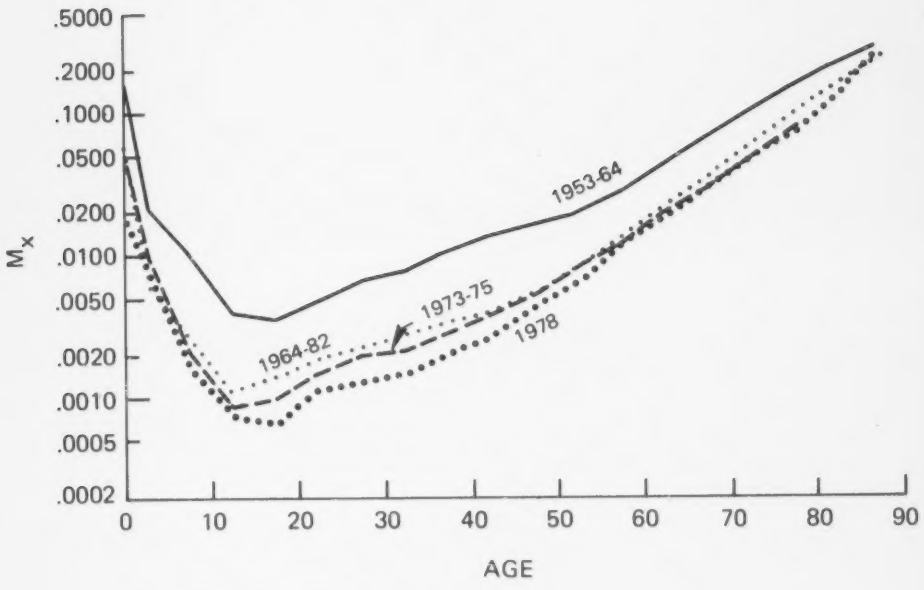


FIGURE 17 Age-Specific Mortality Rates, Females, 1953-64, 1964-82, 1973-75, and 1978: China

constant thereafter. The officially recorded deaths show a large reduction in the crude death rate, interrupted by an increase during the crisis years of 1958-61, with a peak rate of over 25 deaths per 1,000 population in 1960.

Because deaths were much less completely recorded in 1953-64 than in 1964-82, it is clear that the true decline in the death rate was much greater than indicated by the official rates. The crisis years of greatly elevated mortality are within the first intercensal period, when in 11 years an estimated 38 percent of deaths were not recorded, but completeness of recording probably improved and the crisis was near the end of the intercensal interval. In the next interval from 1964 to 1982 only 16 percent of deaths were not recorded. The adjusted deaths given in Table 10 are based on the assumption that about 55 percent of deaths were recorded from 1953 to 1956 and that completeness of recording then rose to 84 percent in 1964, with an average completeness of 62 percent. On this assumption, about 66 percent of deaths were reported in 1960, implying a crude death rate of nearly 39 per 1,000. The number of deaths calculated from the officially listed death rate is 5.90 million in

TABLE 10 Crude Death Rates (per 1,000), 1953-81: China

Year	From Official Sources	Roughly Corrected for Understatement
1953	14.0	25.5
1954	13.18	29.1
1955	12.28	22.4
1956	11.40	20.8
1957	10.80	19.0
1958	11.98	20.4
1959	14.59	23.3
1960	25.43	38.8
1961	14.24	20.5
1962	10.02	13.7
1963	10.04	13.0
1964	11.50	13.5
1965	9.50	11.1
1966	8.83	10.4
1967	8.43	9.9
1968	8.21	9.6
1969	8.03	9.4
1970	7.60	8.9
1971	7.32	8.6
1972	7.61	8.9
1973	7.04	8.3
1974	7.34	8.6
1975	7.32	8.6
1976	7.25	8.5
1977	6.87	8.1
1978	6.25	7.3
1979	6.21	7.3
1980	6.20	7.3
1981	6.19	7.3

1957 and 8.02 million in 1964. Had deaths followed a linear trend from 5.9 million to 8.0 million over these years, the total number of deaths in 1958-63 would have been 41.8 million. The number derived from officially recorded death rates is 57.4 million; by this calculation

the crisis led to an excess of about 16 million deaths. The number of deaths in 1957 and 1964 adjusted for underregistration are 10.4 and 9.4 million. With a linear trend, the adjusted total number of deaths in 1958-63 would have been 59.4 million. The actual total (adjusted for estimated underregis- tration) is 86.2 million, an excess above the linear trend of about 27 million deaths. Thus, excess deaths are 16 million with no allowance for underreporting and 27 million with a rough allowance.

VARIATION OVER TIME

A comparison of the number of persons enumerated at each single year of age in 1982 (from 0-1 to 30-31) with the constructed number of births in each year from 1952 to 1982 provides partial additional evidence of the time variation of mortality in China. If the number of births from July 1 to June 30 were known exactly and if the census enumeration had been exact, the ratio of the enumerated population at age x to x + 1 to the number of births from July 1 x years before 198[illegible] to June 30 x + 1 years before 1982 would be a cohort survival rate. (See note 4 for a description of how fiscal year births were estimated.) The sequence of cohort survival rates indicates which cohorts suffered heavy mortality and which suffered relatively light mortality. These survival rates are shown in Table 3 (above), as are the number of births estimated for each fiscal year and the number in the corresponding cohort in 1982. The survival rate is 0.9 or higher for cohorts born in 1968-69 or later, is at its lowest for cohorts born in 1966-67 and 1963-64, and is below 0.8 for all cohorts born before 1961-62 except 1959-60.

These calculated cohort survival rates do not support the natural hypothesis of especially high infant and child mortality in the cohorts born during the crisis years. The survival rate for the birth cohort of 1960-61 is lower than the survival rate of adjacent cohorts, but not as low as the survival rate of the cohorts born in 1958-59 and earlier. The implied proportions surviving to age 5 in these cohorts, given the proportion surviving from 1964 to 1982, are no higher than 75 to 80 percent.

CHAPTER 6

CONCLUSIONS

The welcome flood of accurate demographic data from China provides an unusually detailed depiction of an extraordinary population. Being the most populous nation in the world has not prevented the People's Republic of China from compressing into a short time very big reductions in fertility (more than 50 percent in a decade) and mortality (more than 20 years added to the expectation of life at birth in about 15 years). The earliest data are not inconsistent with the fertility (about the same TFR) and nuptiality (marriage about 1 year later) of traditional China, as reconstructed from a survey around 1930. The latest data are not inconsistent with some of the principal demographic characteristics of developed countries two or three decades ago. The most recent TFR in China is about the same as in the United States or a typical population in Western Europe in the 1960s; the recent average duration of life is not far from that attained in those populations about 30 years ago. Age at marriage has also changed from the very early norms traditional in much of Asia to ages more like those found in the West.

The rapid changes of fertility, mortality, and nuptiality in China have not been without costs (the excess mortality and abnormal reduction with subsequent abnormal recovery in fertility in the "bitter years"). That the surprisingly rapid changes have also incurred grave social costs can be inferred from the recent decision to reduce pressure for late marriage and from the anomalous high male/female ratio of births of second and higher order in 1981. The marriage boom of 1981-82 is not the only obstacle to attaining and maintaining very low fertility. Further upward pressure on the birth rate in the late 1980s is built into the age distribution of

China's population. In contrast to the reduced number of women in their early 20s in 1982 (because of the greatly reduced birth cohorts for 1958-61), during the next few years the much larger birth cohorts of 1963-70 will be in the normal ages of first marriage and soon thereafter in the very fertile years following marriage.

Doubtless there will be surprises, setbacks, and severe social costs among the future developments in the population of China. The changes will be better understood and the basis for policy sounder if the authorities continue to monitor the dynamics of the Chinese population closely and to continue to publish the data they collect. However, a rich lode of useful information is still to be extracted from the censuses and the fertility survey. This report has used only a fraction of the published data from the survey and has hardly touched the information contained in the census. Analysis of the sort attempted here can be extended to a separate treatment of mortality by sex and to the demography of various subgroups--the population of provinces, persons of various social and economic characteristics, etc. Continued analysis of the data already collected will be as valuable as the continued compilation of new data.

NOTES

1. The analyses based on the sample assumes that the survivors, i.e., those in the sample, do not differ in their fertility experience from nonsurvivors. There is much evidence that this assumption is true and that if there are any differences, they are trivial and do not affect the analyses.
2. The life tables are constructed by an extension of a method devised by Preston and Coale (1982). In brief, the construction involves calculating the number of persons who cross each exact age x in the intercensal period, an estimate derived by interpolation between the number enumerated in each cohort in the earlier and later censuses. When the data are accurate, the method yields a life table that is an exact expression of intercensal mortality by age. A full description of the method is contained in Coale (1984).
3. A more precise estimate can be obtained for each single year of age by allowing for the fact that the proportion surviving from one age to another is not an exactly linear sequence. More appropriate, slightly nonlinear interpolation is achieved by deriving interpolation factors from a model life table at about the right level of mortality.
4. The births derived from the age-specific fertility rates are for calendar years (January 1 to December 31); the births compatible with the census age distributions are for "fiscal" years (July 1 to June 30) because the censuses were taken as of midyear. Fiscal-year births were estimated by a division of the calendar year births into first-half-year and second-half-year births. The difference between first-half-year and second-half-year births was taken

as one-fourth the difference between the births in the preceding year and in the following year. These half-year births were then recombined on a fiscal year basis.

5. It should be noted that a "stopping rule"--no more births after a boy is born, but possibly another after the birth of a girl--is well known not to increase the male/female ratio.
6. The age-specific rates for 1981-82 were obtained by assuming the continuation to the first half of 1982 of the 1981 rates.
7. It is also possible that older women understate the number of births that occurred to them a long time ago and that such understatement may contribute to the low estimates of fertility in the 1940s from this survey. However, the rates are in agreement with data about Chinese farmers, and the agreement of the numbers projected from the births in the 1950s to the 1982 census with the single-year distribution in that census is a convincing indication of no substantial understatement of the births reported as occurring nearly 30 years before the survey.
8. For cohorts that began entering marriage before 1950, the proportion ever married at each age was determined by subtracting first-marriage rates from 0.999, assigned to the age above which no more first marriages in the cohort were reported.
9. This method of life table construction is fully described in an article by Ansley Coale (1984). Constructed examples with artificially perfect data show that the life table is exact if the data used are exact.

APPENDIX: DATA TABLES

TABLE A-1 Calculated Number of Women by Single Years of Age, Aged 15-49 for Each Year, Estimated by Cohort Interpolation (in 100s), 1953-82: China

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
15	46697	47411	47988	50748	52425	49695	51587	53509	59019	62470	62466	64154	73837	73341	85660
16	47587	46763	47383	47854	50500	52289	49498	51430	53450	58868	62129	62033	63662	73793	73238
17	49647	47586	46835	47353	47712	50235	52144	49288	51261	53386	58706	61764	61517	63625	73745
18	55327	49551	47584	46912	47320	47557	49948	51986	49060	51079	53318	58531	61230	61436	63583
19	50876	54656	49448	47582	46994	47285	47393	49642	51819	48817	50886	53245	57932	61128	61349
20	49963	50619	53962	49342	47581	47079	47249	47223	49325	51645	48565	50685	52739	57742	61022
21	45019	49654	50359	53257	49235	47579	47165	47212	47050	49004	51469	48310	50229	52610	57546
22	46048	44817	49335	50090	52530	49124	47577	47254	47174	46872	48673	51288	47849	50131	52476
23	44052	45754	44610	49008	49814	51784	49010	47576	47345	47135	46683	48333	50752	47728	50029
24	44278	43913	45454	44398	48674	49532	51021	48893	47574	47438	47096	46502	47923	50576	47603
25	44912	44012	43772	45146	44182	48331	49243	50241	48774	47572	47534	47055	46060	47856	50394
26	40440	44637	43741	43627	44833	43961	47983	48949	49446	48652	47570	47631	46584	45945	47787
27	40363	40184	44359	43466	43481	44515	43737	47629	48651	48639	48529	47568	47158	46446	45828
28	42435	40137	39926	44078	43189	43333	44195	43511	47273	48350	47826	48405	47119	47023	46307
29	40897	42154	39908	39666	43795	42909	43184	43872	43284	46913	48047	47005	47940	47007	46886
30	39448	40657	41868	39677	39402	43507	42626	43032	43544	43052	46548	47739	46553	47817	46892
31	37181	38975	40414	41579	39442	39135	43216	42338	42879	43212	42819	46178	47259	46434	47692
32	37927	36887	38495	40168	41286	39204	38864	42920	42047	42724	42875	42581	45767	47136	46313
33	37328	37553	36589	38008	39918	40988	38963	38589	42621	41751	42566	42533	42193	45683	47001
34	35729	37015	37174	36288	37516	39665	40688	38719	38311	42318	41453	42407	42043	42106	45598
35	36216	35320	36699	36792	35983	37019	39410	40384	38472	38030	42012	41151	42002	41852	42017
36	36202	35696	34907	36380	36407	35676	36518	39152	40078	38224	37747	41704	40689	41896	41656
37	35358	35713	35172	34491	36059	36019	35368	36013	38894	39770	37974	37462	41239	40519	41788
38	35012	34942	35223	34647	34075	35737	35630	35058	35508	38634	39461	37723	37049	41069	40345
39	34793	34546	34525	34731	34120	33656	35414	35240	34747	35000	38373	39151	37278	36901	40895
40	33476	34422	34073	34102	34232	33586	33232	35087	34844	34432	34486	38109	38677	37098	36749
41	29732	32873	34048	33597	33675	33730	33047	32805	34757	34445	34114	33967	37651	38477	36913
42	29789	29351	32273	33675	33123	33250	33229	32511	32379	34428	34048	33798	33568	37461	38274
43	30348	29364	28973	31678	33306	32653	32830	32733	31980	31958	34102	33655	33417	33409	37270
44	30877	30003	28938	28596	31084	32937	32184	32409	32238	31449	31537	33777	33236	33314	33247
45	29540	30486	29654	28507	28213	30482	32563	31708	31983	31736	30912	31110	33344	33050	33188
46	28572	29076	30085	29296	28066	27822	29865	32181	31221	31547	31222	30361	30682	33145	32858
47	29040	28139	28603	29676	28931	27616	27423	29236	31790	30724	31102	30697	29941	30469	32937
48	28495	28648	27695	28118	29257	28557	27155	27013	28592	31391	30215	30646	30282	29728	30246
49	27249	28035	28246	27240	27621	28828	28174	26682	26594	27932	30981	29694	30180	30077	29506

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
15	87613	91777	97288	88489	92821	95379	70057	69230	54513	78660	139047	125138	118625	124626	110395
16	85605	87483	91693	97151	88383	92684	95192	69947	69290	54423	78847	138700	124781	118878	124892
17	73125	85546	87341	91603	97002	88267	92534	94989	69827	69356	54325	79052	138322	124392	119158
18	73692	73001	85481	87184	91503	96837	88139	92369	94765	69695	69428	54217	79278	137904	123963
19	63538	73634	72867	85411	87015	91395	96659	88001	92190	94523	69552	69506	54101	79523	137453
20	61257	63491	73574	72727	85338	86838	91282	96473	87857	92004	94269	69402	69588	53979	79778
21	60913	61163	63442	73513	72583	85262	86657	91166	96282	87709	91812	94010	69249	69672	53854
22	57344	60800	61065	63392	73449	72434	85184	86468	91045	96084	87555	91614	93740	69089	69759
23	52337	57134	60683	60965	63340	73382	72280	85103	86273	90921	95879	87396	91408	93461	68925
24	49924	52194	56917	60562	60860	63287	73314	72121	85019	86072	90792	95667	87232	91196	93173
25	47474	49815	52047	56694	60437	60753	63232	73244	71956	84933	85864	90660	95449	87063	90977
26	50208	47342	49704	51895	56464	60309	60642	63175	73171	71787	84844	85651	90523	95225	86889
27	47717	50018	47207	49590	51740	56230	60178	60530	63117	73097	71615	84754	85433	90384	94996
28	45711	47646	49826	47070	49476	51584	55994	60047	60416	63058	73023	71441	84663	85213	90244
29	46165	45591	47573	49630	46932	49359	51425	55754	59912	60300	62999	72947	71264	84570	84990
30	46746	46020	45468	47500	49431	46790	49240	51262	55508	59775	60182	62938	72869	71083	84475
31	46775	46603	45871	45343	47424	49226	46645	49118	51096	55257	59635	60061	62876	72790	70898
32	47564	46655	46457	45720	45215	47347	49019	46497	48994	50927	55001	59492	59938	62813	72709
33	46189	47434	46534	46308	45566	45085	47269	48807	46346	48867	50755	54740	59346	59812	62748
34	46863	46063	47301	46409	46157	45408	44952	47189	48590	46192	48738	50578	54473	59198	59684
35	45511	46723	45934	47165	46283	46002	45248	44817	47107	48369	46036	48606	50399	54202	59046
36	41927	45422	46579	45802	47026	46153	45844	45084	44679	47024	48144	45875	48471	50215	53924
37	41458	41835	45332	46433	45668	46886	46022	45683	44918	44538	46939	47915	45713	48334	50029
38	41679	41257	41741	45240	46285	45532	46743	45888	45520	44748	44395	46853	47682	45547	48195
39	40168	41568	41051	41646	45147	46134	45394	46597	45752	45354	44576	44250	46765	47445	45379
40	40717	39986	41453	40840	41548	45050	45979	45252	46447	45612	45183	44399	44100	46675	47201
41	36593	40534	39799	41336	40624	41448	44952	45819	45106	46294	45468	45008	44217	43947	46583
42	36724	36434	40348	39609	41217	40405	41346	44852	45658	44958	46138	45323	44830	44033	43791
43	38069	36534	36273	40160	39418	41097	40182	41243	44751	45494	44808	45980	45175	44650	43846
44	37074	37859	36340	36110	39968	39222	40974	39956	41137	44647	45327	44655	45819	45025	44466
45	33080	36872	37642	36139	35940	39770	39020	40847	39721	41028	44540	45155	44497	45652	44869
46	33056	32905	36661	37417	35930	35764	39563	38809	40715	39477	40915	44429	44975	44332	45479
47	32657	32919	32724	36443	37182	35713	35581	39349	38590	40577	39223	40797	44314	44788	44161
48	32722	32449	32776	32536	36215	36939	35487	35390	39126	38363	40434	38959	40675	44194	44594
49	30014	32496	32231	32627	32339	35977	36684	35251	35191	38892	38125	40285	38684	40547	44068

Note: The number at a given age in a given year was determined by intra-cohort interpolation. For example, women at age 22-23 in 1958 were aged 17-18 in 1953 and aged 28-29 in 1964. The number is estimated as ${}_1N_{17}(53) - f({}_1N_{17}(53) - {}_1N_{28}(64))$ when f is the expected fraction of the total cohort deaths from 1953 to 1964 that occurred while the cohort advanced from 1953 to 1958. This fraction was estimated as $({}_1L_{17} - {}_1L_{22})/({}_1L_{17} - {}_1L_{28})$ from a model life table (West level 9) which is about the proper level of mortality. West levels 15 interpolation factors were used for 1964-82. Note that the use of model life table interpolation factors does not ascribe the given level of mortality to the cohort to which the interpolation is applied. Only the distribution of deaths within each age interval is borrowed from the model table. The survival rate from one census date to the next is taken from the censuses themselves.

TABLE A-2 Population by Sex and Single Years of Age, 1953, 1964, and 1982 (after adjustment): China

Age	Female	Male	Sex Ratio	Age	Female	Male
1953[a]						
0	94001	98588		50	27996	29210
1	108081	114115		51	24582	26036
2	84684	90267		52	24923	25780
3	81241	88242		53	22365	22987
4	69997	76565		54	21082	22153
5	57637	74708		55	21710	23217
6	65575	73358		56	20458	21733
7	60068	67793		57	20193	20554
8	53831	61281		58	21083	20784
9	52301	50364		59	19655	19205
10	50492	58890		60	20899	20121
11	52925	61718		61	17311	16814
12	51531	60585		62	16402	15476
13	48291	57107		63	15876	14683
14	47443	56768		64	15690	14134
15	46697	55514		65	15170	13294
16	47587	55361	1.1634	66	13708	11975
17	49647	57168	1.1515	67	12748	10762
18	55327	63002	1.1387	68	12038	9790
19	50876	58537	1.1506	69	11009	8972
20	49963	57259	1.1460	70	11598	8977
21	45019	51387	1.1415	71	10078	7634
22	46048	52436	1.1387	72	9556	6882
23	44052	50042	1.1360	73	8209	5772
24	44278	50137	1.1323	74	6292	4298
25	44912	50732	1.1296	75	5736	3781
26	40440	45533	1.1259	76	5107	3231
27	40363	45336	1.1232	77	4397	2689
28	42435	47508	1.1195	78	4023	2340
29	40897	45674	1.1168	79	3300	1840
30	39448	43948	1.1141	80	2998	1577
31	37181	41321	1.1113	81	2162	1108
32	37927	42011	1.1077	82	1921	931
33	37328	41246	1.1050	83	1472	682
34	35729	39348	1.1013	84	1139	500
35	36216	39786	1.0986	85	910	387
36	36202	39671	1.0958	86	642	258
37	35358	38617	1.0922	87	461	177
38	35012	36143	1.0894	88	348	127
39	34793	38054		89	215	75
40	33476	36481		90	179	66
41	29732	33085		91	94	30
42	29789	32313		92	67	21
43	30348	32344		93	47	15
44	30877	32718		94	33	11
45	29540	31083		95	29	11
46	28572	30202		96	23	8
47	29040	29985		97	15	5
48	28495	29131		98	13	4
49	27249	28503		99	8	3
				100	17	16

[a]Adjustments for 1953: The male population ag d 16-38 was inflated so as to match the estimated sequence of males/females by age, and to add in 6.8 million males (the difference between the population total for the official age distribution and the total listed as "well enumerated"). The whole population was inflated by 582.6/574.2 to allow for the 8.4 million "indirectly enumerated."

TABLE A-2 (continued)

Age	Female	Male	Sex Ratio	Age	Female	Male
1964[b]						
0	140747	145104		50	30559	31140
1	148386	155164		51	26553	26949
2	75983	80256		52	25259	25579
3	56138	59619		53	24641	24356
4	69044	74509		54	26069	24904
5	71768	77587		55	25947	24137
6	97666	107001		56	23658	21733
7	94414	103429		57	23014	20895
8	89702	97725		58	23957	21052
9	98615	107124		59	22462	19679
10	92773	100017		60	21973	19021
11	88714	9531[illegible]		61	20792	17947
12	86440	92580		62	18900	15966
13	74092	80266		63	18500	15363
14	74416	81905		64	15975	12965
15	64154	70996		65	14236	11471
16	62033	69353	1.118	66	14278	11321
17	61764	69299	1.122	67	12912	10117
18	58531	65847	1.125	68	12486	9404
19	53245	60114	1.129	69	11815	8779
20	50685	57375	1.132	70	10768	7657
21	48310	54880	1.136	71	9917	6983
22	51288	58417	1.139	72	8835	5976
23	48333	55245	1.143	73	7569	4985
24	46502	53291	1.146	74	6982	4423
25	47055	54113	1.150	75	6325	3885
26	47631	54919	1.153	76	5555	3253
27	47568	53870		77	4715	2696
28	48405	54442		78	4061	2213
29	47005	52369		79	3309	1730
30	47739	53702		80	2813	1438
31	46178	51530		81	2358	1145
32	42581	47732		82	1934	891
33	42533	47562		83	1550	656
34	42407	46689		84	1186	488
35	41151	45145		85	738	303
36	41704	45607		86	544	212
37	37462	41539		87	414	151
38	37723	41154		88	306	107
39	39151	42480		89	210	73
40	38109	40734		90	151	55
41	33967	36327		91	86	29
42	33798	36130		92	60	21
43	33655	35709		93	42	16
44	33777	35494		94	33	14
45	31110	32329		95	28	14
46	30361	31550		96	22	10
47	30697	32036		97	15	7
48	30646	30949		98	14	7
49	29694	30254		99	11	7
				100	30	21

[b]Adjustments for 1964: The male population aged 16-26 was inflated so as to yield the indicated sequence of sex ratios, which added 2.35 million. The male population at every age was inflated by a factor of 1.0069 and the female by a factor of 1.0071 to allow for 4.9 million persons listed as age unknown.

TABLE A-2 (continued)

Age	Female	Male	Sex Ratio	Age	Female	Male
1982[C]						
0	100280	107820		50	40413	45293
1	83624	90173		51	38092	43421
2	88114	94629		52	39792	44674
3	94924	101313		53	37054	40770
4	90303	95988		54	37547	41452
5	94079	100134		55	33776	37048
6	98949	105211		56	33241	35930
7	105542	112211		57	34133	36435
8	116622	123685		58	33221	34765
9	121718	129165		59	29725	30820
10	122221	129948		60	30388	31222
11	132417	140861		61	28551	29081
12	128559	136396		62	28243	28578
13	137231	145161		63	25142	24594
14	118980	126250		64	24354	23672
15	110395	116975		65	24853	23282
16	124892	134796	1.079	66	23255	21589
17	119158	128607	1.079	67	21606	19912
18	123963	133793	1.079	68	22265	20187
19	137453	148353	1.079	69	18943	16781
20	79778	86104	1.079	70	17427	15101
21	53854	58125	1.079	71	16627	14061
22	69759	75291	1.079	72	16054	13038
23	68925	73977		73	15543	12006
24	93173	101287		74	13449	10184
25	90977	97922		75	12204	8892
26	86889	92329		76	11732	8166
27	94996	101737		77	10935	6873
28	90244	95934		78	9096	5985
29	84990	89893		79	8043	5060
30	84475	89089		80	6944	4235
31	70898	75406		81	5792	3384
32	72709	80061		82	4466	2503
33	62748	68850		83	3407	1843
34	59684	65659		84	2960	1532
35	59046	65083		85	2341	1188
36	53924	59015		86	1839	853
37	50029	55607		87	1440	638
38	48195	54214		88	1054	453
39	45379	51542		89	774	307
40	47201	53288		90	618	248
41	46583	53332		91	384	137
42	43791	49871		92	277	99
43	43846	50021		93	184	60
44	44466	51412		94	117	44
45	44869	51047		95	98	37
46	45479	51050		96	57	23
47	44161	48790		97	40	18
48	44594	49955		98	31	15
49	44068	49628		99	22	11
				100	27	11

[C]Adjustments for 1982: The number of female members of the armed forces were allocated as follows: 20 percent to age 19; 60 percent to age 20; and 20 percent to age 21. The number of males at each age from 16-22 was estimated as 1.079 times the number of females at the same age, adding 4.1 million males and 0.1 million females, totaling the listed 4.2 million military personnel.

TABLE A-3 Proportion of Children Born Alive Who Were Born in Specified Years, by Age of Mother, 1982: China

Year of Birth	Age of Mother							
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
81-82	.681	.398	.144	.030	.009	.003	.001	.000
80-81	.219	.254	.146	.036	.010	.004	.001	.000
79-80	.066	.152	.141	.050	.014	.005	.001	.000
78-79	.027	.093	.132	.066	.020	.008	.002	.000
77-78	.007	.052	.109	.074	.025	.010	.004	.001
76-77		.028	.093	.083	.032	.015	.006	.001
75-76		.014	.077	.090	.042	.020	.009	.002
74-75		.005	.062	.095	.053	.026	.013	.004
73-74		.002	.044	.096	.064	.035	.018	.006
72-73		.001	.027	.090	.072	.043	.024	.010
71-72			.016	.083	.079	.050	.031	.014
70-71			.007	.073	.084	.058	.036	.019
69-70			.003	.055	.085	.061	.040	.024
68-69			.001	.039	.086	.068	.045	.029
67-68				.022	.077	.068	.046	.031
66-67				.012	.067	.067	.047	.034
65-66				.006	.060	.071	.052	.040
64-65				.002	.049	.070	.054	.041
63-64				.001	.039	.075	.061	.049
62-63					.023	.072	.065	.052
61-62					.008	.046	.047	.037
60-61					.003	.030	.037	.030
59-60					.001	.026	.040	.035
58-59					.001	.025	.046	.043
57-58						.022	.054	.051
56-57						.013	.052	.053
55-56						.007	.046	.052
54-55						.003	.041	.054
53-54						.001	.032	.052
52-53							.023	.052
51-52							.014	.047
50-51							.007	.041
Before 1950							.004	.063

TABLE A-4 Proportion of Ever-Married Women (per 1,000 women) by Single Years of Age, Aged 15-35, Constructed from First Marriage Rates, 1950-81, and Reported in the Sample Survey, 1981: China

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
15	65	74	54	40	35	32	31	29	28	25	23	23	24	24	19	14	12
16	219	211	192	158	137	125	118	113	107	98	90	89	95	92	79	64	50
17	412	375	360	337	307	281	261	253	246	225	206	205	215	222	195	160	136
18	574	565	533	518	495	475	451	426	418	394	362	358	377	392	369	314	270
19	694	704	693	672	652	636	629	604	573	552	528	512	538	561	543	497	434
20	795	799	803	794	777	756	746	747	718	675	661	658	666	694	687	647	603
21	861	867	869	870	861	849	830	823	825	790	754	760	775	783	790	763	724
22	905	907	911	915	912	906	897	878	872	873	843	821	844	858	849	848	819
23	931	934	937	942	944	940	936	931	913	905	909	890	880	901	903	890	890
24	950	952	954	956	961	963	960	958	952	934	929	941	929	919	935	931	918
25	967	967	968	969	971	975	976	974	971	965	949	949	965	954	941	954	952
26	977	978	977	977	978	980	984	985	982	980	975	961	964	979	966	954	970
27	983	984	984	983	983	985	987	990	990	988	986	982	970	972	987	974	963
28	987	986	988	988	987	988	989	991	993	993	991	991	988	975	977	991	978
29	991	990	990	991	992	990	991	992	993	995	995	994	994	991	978	979	993
30	993	993	992	992	994	993	992	993	993	995	996	996	995	996	993	981	981
31	994	994	994	994	994	995	995	994	994	994	996	998	998	997	997	994	982
32	995	995	995	995	995	995	996	995	995	995	995	997	998	998	997	997	995
33	997	996	996	997	996	996	996	997	996	995	996	996	998	999	998	998	998
34	997	998	997	997	997	997	997	997	997	996	996	997	997	998	999	999	998
35	997	998	998	998	998	998	998	997	997	997	997	997	997	998	998	999	999

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
15	10	10	9	8	8	6	5	5	5	4	3	3	2	2	2	2
16	42	42	41	36	31	26	20	17	17	14	12	11	9	9	10	8
17	116	109	110	100	84	71	58	45	39	36	30	28	26	24	26	24
18	249	231	225	218	188	157	134	109	89	76	69	61	59	61	60	60
19	401	390	374	361	337	292	245	207	173	144	127	117	108	115	128	121
20	553	538	540	513	480	445	389	332	286	246	213	194	184	186	226	261
21	696	670	674	669	617	572	537	480	421	375	333	301	290	295	329	384
22	790	785	776	775	755	696	651	622	570	518	478	441	419	427	463	508
23	869	855	862	849	840	818	759	723	705	668	625	593	572	569	612	668
24	924	914	909	915	895	884	866	814	790	789	762	727	716	719	739	793
25	942	955	951	943	946	924	917	906	861	848	860	841	821	835	852	879
26	969	961	977	971	960	962	944	942	936	899	895	913	903	899	921	927
27	981	981	973	987	979	969	974	958	960	960	926	925	949	947	945	960
28	969	988	988	979	992	984	976	981	966	973	975	942	944	971	969	979
29	981	973	993	992	981	995	988	980	985	972	979	984	954	956	982	985
30	995	983	975	995	993	983	997	990	982	988	974	984	990	961	962	988
31	982	996	985	976	995	995	985	998	992	984	990	977	987	994	965	991
32	983	983	997	985	976	996	996	986	999	993	986	991	978	989	996	990
33	996	983	984	997	985	977	996	996	986	999	993	986	992	979	990	995
34	999	996	983	984	997	985	977	997	997	986	999	993	987	993	980	995
35	999	999	996	983	984	997	986	977	997	997	987	1000	994	988	994	996

Note: The first marriage rate given for the earliest age (15) in a given year is approximately equal to the proportion ever married at exact age 16 at the end of the year. Addition of the first-marriage rate at 16 in the next year yields the proportion ever married at exact age 17 at the end of that year. For a given year (say 1970) and a given single-year age interval (say, 20 to 21), there are four relevant calculable proportions of ever-married women: at exact ages 20 and 21 at the beginning and end of the year. The proportion ever married at 20 to 21 in mid-1970 is taken as the arithmetic mean of these four numbers.

TABLE A-5 Number of Ever-Married Women (in 100s) by Duration Since First Marriage, 1970-82: China

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
0	63774	57380	54166	53399	53596	56004	60271	63828	67433	74804	87422	101710	115044
1	64462	63653	57273	54065	53292	53487	55883	60136	63679	67163	74659	87257	101529
2	56053	64329	63531	57159	53955	53182	53371	55760	59996	63425	67036	74512	87088
3	46590	55929	64193	63400	57042	53845	53068	53249	55633	59759	63301	66903	74362
4	41157	46476	55801	64052	63268	56925	53732	52949	53128	55415	59639	63173	66766
5	41271	41047	46365	55671	63911	63131	56804	53613	52827	52920	55308	59524	63044
6	47509	41152	40937	46247	55541	63764	62995	56680	53493	52623	52819	55199	59402
7	55878	47357	41030	40823	46126	55405	63615	62852	56548	53288	52523	52715	55086
8	54014	55698	47205	40903	40708	46006	55268	63462	62706	56333	53187	52422	52610
9	45300	53836	55514	47052	40775	40587	45883	55126	63305	62461	56227	53087	52318
10	38747	45186	53624	55326	46895	40646	40470	45794	54982	63014	62343	56121	52983
11	38230	38623	45035	53409	55135	46736	40514	40389	45665	54718	62884	62220	56010
12	41338	38109	38494	44854	53222	54941	46607	40383	40261	45432	54595	62752	62093
13	42024	41237	37981	38336	44699	53031	54744	46443	40242	40038	45316	54469	62613
14	41703	41920	41099	37863	38207	44538	52839	54510	46271	40007	39924	45204	54341
15	40837	41568	41778	40970	37773	38069	44342	52649	54264	45991	39882	39852	45048
16	40353	40703	41427	41614	40867	37673	37895	44189	52368	53936	45875	39757	39743
17	40503	40218	40560	41261	41507	40718	37537	37772	43942	52055	53748	45759	39634
18	40846	40371	40078	40403	41117	41389	40570	37418	37550	43635	51868	53594	45605
19	42855	40745	40229	39894	40300	40996	41202	40445	37197	37320	43478	51731	53371
20+	426534	434765	440660	446463	448001	449403	453142	456971	456900	453781	449152	452197	461760

Note: Calculated from first marriage frequencies at each age for each cohort, the proportion ever married (Table A-4) and the number of women (Table A-1).

TABLE A-6 Number of Births and Marital Fertility Rate at Each Duration of Marriage, 1970, 1977, and 1981: China

	Number of Births			Duration-Specific Fertility		
	1970	1977	1981	1970	1977	1981
0	513	833	1730	.08087	.13084	.17009
1	3152	3243	5705	.49156	.54068	.65382
2	2265	1892	2562	.40623	.34018	.34384
3	1826	1723	2051	.39401	.32440	.30656
4	1545	1525	1597	.37735	.28875	.25280
5	1302	1450	1302	.31711	.27113	.21874
6	1372	1252	1046	.29030	.22144	.18950
7	1600	1234	809	.28783	.19682	.15347
8	1741	1082	729	.32401	.17091	.13906
9	1326	904	609	.29424	.16438	.11472
10	1198	687	488	.31080	.15038	.08695
11	914	542	479	.24030	.13452	.07698
12	1087	461	376	.26432	.11443	.05992
13	976	414	311	.23344	.08936	.05710
14	1024	391	270	.24680	.07190	.05973
15	900	403	187	.22152	.07672	.04692
16	873	313	170	.21747	.07100	.04276
17	793	314	148	.19679	.08333	.03234
18	767	217	138	.18874	.05813	.02575
19	685	218	142	.16067	.05403	.02745
20+	3436	899	493	.08099	.01972	.01090

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